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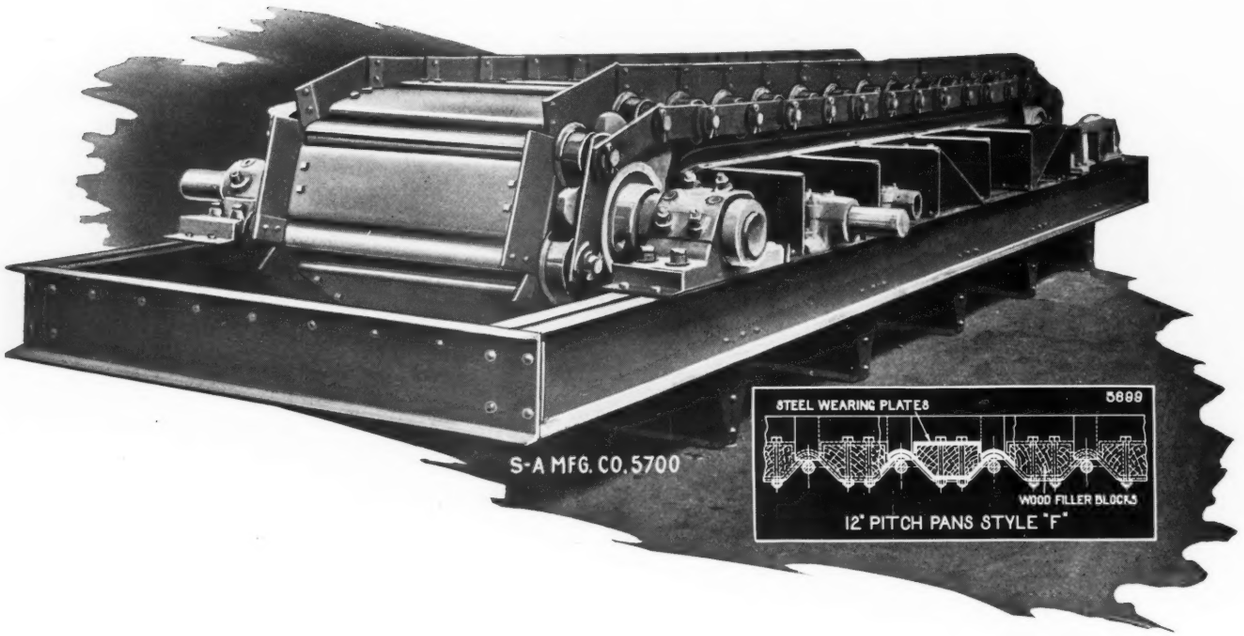
August 12, 1922



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The Dust Problem in Dry-Crushing Operations

IT HAPPENS occasionally that an ore must be crushed dry to a comparatively small mesh prior to roasting, sliming, and agitation treatment. In this case the dust problem is solved with comparative ease; its removal from the atmosphere is effected by one of several available methods; its return to the ore may be intermittent, without disturbing unduly the physical equilibrium of the mass.

In bulk leaching operations, however, although simple means may be used to collect the dust, it is imperative in those cases in which comparatively large amounts of finely-divided products are freed from the ore that it be returned at the rate and in the proportion at which it was abstracted. Dust—often colloidal clay—is a most refractory material, from the physical point of view, when not added uniformly to a leaching charge; if in reasonable amount, if evenly distributed, provided there is an adequate bottom support in the vat and that a normal rate of flow of percolant is maintained, no trouble need be anticipated; the extraction of soluble from such material, which is sometimes highly plastic when wetted, is usually more than could be obtained were it isolated, and treated separately by a filtration system involving the use of pressure or vacuum. This is due to the fact that a much longer time is available for the release of absorbed and adsorbed solution by replacement and diffusion, into and by means of weaker solution and water.

It is practicable to design a plant so that little dust can escape into the surrounding atmosphere when crushing is practised to a degree that is advisable as a preliminary to the bulk treatment of ores by submergence and leaching. Suction fans are used for this purpose almost exclusively. The dust may then be deprived of its coarser particles by the use of conical settlers, with automatic trap feeders, arranged to return the fine sand to the ore stream in approximately the same proportion in which it was freed during crushing and handling. Equally satisfactory methods are available for the continuous collection of the finer dust, but these involve the purchase of comparatively expensive apparatus. One well-known system makes use of closely-woven bags, several of which are arranged, in a suitable metal casing, to form a unit. The dust as collected falls into the bottom of the receptacle, which is conical, and can be fed to the conveyor that carries the main stream of ore from the secondary crushing plant to the leaching vats. Unfortunately, although highly efficient such a system is not simple. The bags require thorough cleansing at frequent intervals by mechanical means, whereby periodic jars are given to the filtering media. Compressed air is needed to operate the necessary mechanism.

To prevent repeated trouble from this cause it is practicable in some cases to dampen the finest dust prior to returning it to the belt conveyor, but it is doubtful whether this is ever entirely satisfactory. Agglomeration is likely to result, and it must be realized that little or no extraction of soluble can be effected from material in such a condition. What is far more serious, walls of impervious slime are likely to form; these block the passage of solution through sections of the charge, causing short circuiting and high rate of solution flow elsewhere in the vat.

The usual practice in dry-crushing plants is to divert the exhaust from the suction fan into a frame chamber, covered with burlap or other permeable material, in which the dust settles. The air escapes through the pores of the cloth that forms the walls; the fine material is shoveled periodically onto the belt conveyor taking the crushed ore to the vats. It is probable, however, that the extraction of soluble from such undersize, when transferred intermittently thus, does not compensate for the disorganization in solution flow that results from the presence of an abnormal amount of fine slime in a comparatively small amount of ore.

Insufficient attention has been paid to the dust problem in many cases; a plant, apparently, can operate at a high technical efficiency when it has been disregarded. It is a question of economics as to whether electrical precipitation of the dust formed during dry-crushing prior to bulk leaching would be a satisfactory solution of the problem. The ore is usually low grade; hence the prevention of atmospheric pollution may be considered as an unnecessary and costly refinement. This attitude is not justified. The cost of construction of the necessary electrical equipment would not be high; the dust to be settled is at normal atmospheric temperature. The advantages accruing from the proper handling of dust by continuous mechanical means are such that any reasonable expenditure for the necessary equipment is justified. At the same time there is scope for the introduction of a complete system involving low first cost and combining efficiency with simplicity of operation.

Labor—The Copper Industry's Toughest Problem

THE COPPER MINES in the United States are having serious difficulty in procuring an adequate supply of competent labor. Complaints come from many important producing centers to the same effect—men are not returning to the mines, and the labor that has been recruited is proving unsatisfactory. The reason for this situation is fundamentally the fact that wages and attractions of other industries overbalance those of copper mining.

When practically the entire copper-mining industry in the United States ceased operations last year thousands of miners were forced to seek employment elsewhere. Those men with families to support were driven by dire

necessity to engage in some form of activity; probably for the first time many miners learned that they could work at other trades—some in the oil fields, others in automobile factories, and still others at farming. To many the change was welcome. From an occupation that had many disagreeable features they turned to undoubtedly pleasanter tasks for a remuneration that compared favorably with a mining wage. The miner discovered a latent versatility and took advantage of economic conditions—unequal wage scales and varied activity in industry—to improve his position, for which he surely cannot be blamed.

Many foreign-born miners returned to southern Europe intent upon spending their savings in Italy or other countries where depreciated exchange made it tempting to do so. Some of these miners, having failed to take out citizen's papers, will find it difficult to return, owing to our present immigration laws restricting the flow of immigrants to this country.

What are the copper mines to do? Take Butte, for an example, where the situation is particularly aggravated. Several thousand men are urgently wanted. The influx into the camp has been comparatively small. Men have been hired whose experience covers everything but mining, and the character of the work done by such a force has consequently suffered. These unskilled recruits had to be trained—always a costly matter—and the output per man has been affected. It has been difficult to maintain discipline, as the miners know that a shortage of men makes it easier for them to retain their positions or to obtain others in the event of "drawing their time."

Butte has had much disagreeable labor trouble, the mines are getting warmer with greater depth, the ground is often heavy, and living conditions, as far as the mines are concerned, have only one advantage, but an important one—that of city life. How is the camp to compete at $4.25 a day with, say, a minimum wage of $5 to $6 in automobile manufacturing centers? At present Butte has a plentiful supply of itinerant labor. Miners with a family are decidedly in the minority. In fact, the stranger to Butte cannot help but notice the scarcity of well-kept cottages of the mine laborer working for day's pay. Butte is not a city of beauty, nor does it have to be, but several alleys and streets may hardly be termed tempting as a residence for prospective miners.

Of course, one solution of the predicament would be to sit tight until wages are adjusted throughout industry. But then the problem arises as to whether they will ever return to their pre-war relationship. Another way out would be to make living and working conditions so attractive that the pulling power of other fields of work may be compensated.

Attempts have doubtless been made in the past to improve the status of the miner, often with discouraging results and a lack of appreciation on the part of the miners of the effort made to help them. This consequence is usually the reflection of the attitude taken by a class of workers with Bolshevistic leanings, who feel that there is no end to the interest which should be taken in their welfare and to which they are entitled.

Agitators have often created much bitterness between employer and employee, and strikes—the culmination of the agitator's work—have driven the miner with a family from fields where employment was interrupted and uncertain, to places where trouble was more infrequent. Butte has suffered in company with other camps, and its reputation as a place where steady employment is assured has been hurt appreciably. Few industries, however, have been immune from some form of labor trouble in the past four years, but most of them have generally been more fortunate than the copper industry in being able to maintain production in the face of a depressed period. The better outlook for copper helps to assure the copper miner of steady employment for some time to come.

Another way out of the dilemma would be to raise wages to a level commensurate with those paid in competing activities. Such a step would be quickly reflected in the higher cost of producing copper—and fourteen-cent copper is no inducement to raise wages, while $4.25 per day is no inducement to raise a family.

Now that the spotlight is focused on the coal and railroad strike, the troubles of the copper and other mining industries are temporarily submerged, but the directing officials of the copper mines are fully aware of their importance. Much serious thought must be given to the matter and many trials and tribulations must be overcome before a satisfactory answer can be found.

The ultimate solution will likely be of great interest to other mining camps—whether it be the fruit of time-keeping studies, complete contracting of mine work, establishing a model community of miners' homes, greater recreation facilities, or some other method of attack.

On Being in the Open

THERE ARE DISADVANTAGES over living in the open—even sleeping out of doors. Mosquitos may get you now and then: you may get chilled or rained on. But these disadvantages are offset a thousand times by the greater vigor, the healing effect on mind and body of pure air and the close contact with the rest of nature.

It is like this with living one's mental and moral life in the open. What we are secretive about—what we hide—must ordinarily be because we are ashamed of it or because we fear the consequences. We cover ourselves with as fair and dazzling a cloak as we can manufacture, and present ourselves, scrubbed and shining, to the world. The cloak is too often largely woven partly of hypocrisy: anyhow we fear its removal. With the best interpretation, what man but would be mortified at having his shirt suddenly torn from his back on the street, to say nothing of his trousers?

Business nowadays is fearful of government interference, not only of government control, but of actual charges of conspiracy, indictments for law-breaking—as, for example, against the Sherman act. It is fearful; and it cautiously, in many cases, covers itself with a cloak of secrecy. It will not expose its operations. It refuses to give its figures to the public. Whatever the rights and wrongs of the coal strike, the operators have to do with a coolly critical government and a sceptical public because they refuse to lay their cards on the table: they will not bare the facts and give all their figures for open inspection. That spells trouble. Secret diplomacy has been definitely bested by the frank shirt-sleeve diplomacy of the United States Government. We have no gum-shoe intriguing diplomats in the State Department, or few. We want none in business or in labor, or in politics.

Mining organizations may know where they are, by this simple formula. Are their cards on the table? Are their statistics open to the public? If they are, they need not shrink behind their cloak. If they are not, they probably need the cloak they have provided: but they are always open to the catastrophe of having it pulled off.

A Million Years

HOW LONG IS TIME? How long has been the past? We say that we are in the year 1922, dating back to the birth of Christ. But records show a long period of Eastern civilization before that date, running back some thousands of years. Then historical records are no longer available. But it has been estimated that the cave men of Europe, who hunted the hairy mammoth and made very creditable drawings of these animals on the walls of their caves, lived some 25,000 years ago. Iron began to be used for tools some 3,000 years ago, copper about 5,000 or 6,000 years ago. Between 25,000 and 125,000 years ago there lived in Europe men who used stone and bone for the fashioning of implements—short, powerful, stooping, brutish men. From 100,000 to 300,000 years ago, men still more brutish, with chimpanzee-like jaws, existed. Between 200,000 and 350,000 years ago a still more primitive type, with human teeth but simian jaws, lived in Europe. And the earliest type of man whose remains have been discovered lived more than 475,000 years ago, in Java: he had a brain capacity intermediate between that of modern man and the modern great apes. Still he walked upright and was five feet seven inches tall, which is about the average height of man at present.

These estimates of age have been made from the character of deposits in which the human bones have been found imbedded; and the age of the deposits has been approximately ascertained from various data.

Men of even a rudimentary education in earth science are familiar with the process of erosion, by which the rocks are gradually worn away and carried as mud and sand by the streams into the ocean. They know that by this process the Colorado River has cut down its stupendous canyon through the mainly horizontal rocks of its course. One of the most reliable and striking measures of time results from the study of erosion. By measuring the amount of solid matter discharged at the mouth of the Mississippi during the year, for example, and calculating its distribution over the whole Mississippi drainage basin, it is found out how much the surface of the basin is yearly lowered by erosion. This has been done, and it has been found that the rate is one foot in 4,500 years! Similarly the basin of the Colorado River at Yuma is being lowered one foot in 5,300 years. In mountain countries, of course, the speed of erosion is much greater. The basin of the Po is being lowered one foot in 729 years; that of the Ganges one foot in 823 years.

If one goes into a primeval forest, and has the opportunity to examine a newly cut ancient tree, he may easily count hundreds of the annual rings, each of which infallibly represents a yearly round of the seasons. And in the redwoods of California the count may run up into a few thousand rings. Yet one looks in vain for the evidence of great changes in the surface during the tree's existence. It stands, apparently, just as it sprouted. How long, then, was required to carve out the mountain valley in which we find it? If we acknowledge, in accordance with erosion estimates derived from the burden of silt in rivers, that a foot of soil has been removed from around the roots of our two-thousand-year-old tree, or between the trees, and if the valley is a thousand feet deep, we arrive at once at a rough measurement of the time required to wear down the valley, of two million years, by a calculation so simple and by a method so clear that the approximately correct value is easily and certainly grasped, by anyone, be he scientist or bookkeeper. And if he is somewhat of a geologist, even if a very amateur one, and knows, which is true, that the erosion of such a valley is a recent occurrence in a geological record which is vastly longer, then he begins to have some rough conception of time—let us not say geologic time, but simply time—during which the creatures of the earth have lived, flourished, and died before we—you and I—made our triumphal entry upon the scene.

The first reaction—the usual comment—is that conceptions of time which involve a million years and more are too much for the human brain to grasp. That is only a matter of habit, to be corrected by a little practice in thinking. A great many men have concentrated their thoughts until they have a very good idea of what a million dollars is; and, if they are the possessors of that amount, have a very clear conception of its distribution and its qualities in general. Their conception of numbers when applied to dollars does not stop short at five thousand, as they feebly declare it does with years! And even if you remind them that a million dollars is a hundred million cents, they would still have a perfect comprehension of what a hundred million means. If, therefore, they could be thoroughly convinced that time is money, they would have little difficulty in thoughtfully weighing and appraising all geologic time; of which the best estimate, from the Cambrian period to the present, is about six hundred million years. The dawn of life on earth was much earlier than this; and, based upon studies of radio-activity, physicists have granted certain uranium minerals, which have been examined in the Archæan rocks, an age of one and a half billion years at least. And with this estimate we may, perforce perhaps, rest for the present. For although the subject should be a simple one for millionaires and statisticians to visualize intelligently, there are others of us who have always been unable to grasp the idea of a million dollars, and, like the man who cannot mentally acknowledge a million years, have been tempted to exclaim of a million dollars, "There ain't that much money in the world!"

The Golden Fleece

A RECENT ISSUE of the London *Times* quotes the *Cape Argus* as stating that "what is described as the richest gold reef in the world" has been found in the Keetmansdorf district, the "average yield" being 4 oz. 11 dwt. per ton. We would like to believe that, for what the world needs today is a good tonic, and of all tonics the discovery of a new and rich gold field would be the most effective to cheerfulness, if not the best for industrial health. Meanwhile it is pleasant to note the resumption of operations at many gold mines in our West, particularly California. The prosperity of gold mining just now lies largely in the reopening of old mines and the discovery of ore in abandoned workings. For that there is large scope.

THE JOURNAL-PRESS STAFF

DEMETRIUS EDWARD ALEXIS CHARLTON

THE managing editor of the *Journal-Press* was born in 1885 at Detroit, Mich., of English parentage. At the age of three months he went to England, but returned three years later and settled in Marquette, Mich. Charlton was graduated from St. John's Military Academy, Delafield, Wis., in 1903. In the preceding summer he had worked on construction of the Pioneer Iron Co.'s furnace at Marquette—unloading bricks and running a stationary hoisting engine—and during the summer of 1903 he was again on road construction, with an engineering crew at Grand Island, Mich.

DEMETRIUS EDWARD ALEXIS CHARLTON

Undecided whether to take up literature or mining engineering, Charlton chose the latter as affording a greater diversity of excitement, and entered the Michigan College of Mines in the fall of 1903. Perhaps one of the reasons which prompted his selection of this institution was the fact that, except for one building, all of the structures of the school had been designed by his father, D. Fred Charlton.

In the spring of 1905 "Ted" Charlton, as he is affectionately diminutived by his friends, began practical work, after being "let out" for failure to make the "grade" at Houghton. The latter experience he says he now regards as a happy circumstance, declaring that it made him realize that he would have to give serious application to all features of mining work, and it also gave him a better insight regarding the requirements of his subsequent technical study. After some months as engineer on railroad construction for the Marquette & Southeastern Ry., he entered the employ of the Oliver Iron Mining Co., on the Mesabi Range, where he worked as levelman on topography, draftsman in charge of exploration records, and finally assistant mining engineer in opening up the McKinley mine, at McKinley, Minn.

During the summer of 1907 Charlton returned to Houghton to resume his studies at the College of Mines, remaining there the two years following, with the exception of one summer when he was assistant mining engineer for the Verona Iron Mining Co. in the Iron River district of Michigan.

Leaving Houghton in the spring of 1909, Charlton struck out for Arizona, where his first job was that of underground sampler for the Detroit Copper Mining Co., at Morenci. Later he was placed in charge of the sampling department, then considerably enlarged and under the direction of Frank Pelton, geologist for the company at Morenci. Following the urge of the average mining engineer, he left Morenci early in 1910 for Utah, and became assayer for the Chief Consolidated Mining Co., at Eureka, remaining in the district for about three years. He returned to the Michigan College of Mines during the summer of 1910 to take the geological field course, the completion of which secured him the degree of Engineer of Mines. While in the Tintic mining district he was, for a time, mining engineer and assayer for the Victoria Consolidated Mining Co.

From the latter part of 1912 to February, 1914, Charlton was employed as mining engineer by the Oliver Iron Mining Co., Virginia, Minn., and for almost three years as safety and efficiency engineer for the same company. He was one of the organizers of the Engineers' Club of Northern Minnesota, its first secretary, and later president. He took an active interest in civic affairs, and was elected justice of the peace of Franklin Village, although he admits that he never held court, tried a case, issued a restraining order, or got any of the mine crew into trouble by performing a marriage ceremony.

Charlton came to the editorial staff of *Engineering and Mining Journal* in 1917, and was made managing editor in 1919. He collaborated with G. J. Young in getting out the "strike" editions of the *Journal* at San Francisco in 1919 and 1920 that resulted through the "vacations" which the mechanical forces of the New York print shops enjoyed at that period. He is a member of the A. I. M. E., serving on the engineering license and program committees of the New York Section, and is also chairman of the program and publication committee of the Mining Section of the National Safety Council.

Charlton has achieved considerable reputation as a raconteur, all readers of the *Journal* and the *Journal-Press* and a wide circle of friends being familiar with his "Cousin Jack" yarns. He admits having acquired all dialects except the Finnish, but there is time for that, as he is only thirty-seven. In 1911 he was married to Edith Russell, and they have two sons—both real boys, according to their dad.

During his service with the *Journal* and *Journal-Press* Charlton has successfully applied that knowledge of human relationship which he absorbed in practical work, and, as all readers know, the paper gets out on time each week—and not by accident. Versatile, likable, and skilled in "human engineering," he gets results without noise or apparent effort.

The Galbroseries of Geology

BY T. A. RICKARD

GEOLOGY lends itself to humbug because it is expressed in Greek-Latin terms the meanings of which usually are not too closely scrutinized. Thus I have received a printed report on a mine belonging to the Mohave-Rand Silver Corporation. This report is by a gentleman who affixes 'E. M.' to his name, whether properly or not, I do not know. I forbear from giving his name, as my criticism is entirely impersonal. According to him, the lode is close to "a vast dike belonging to the basalt galbroseries". What is that? I am proud to have guessed it: gabbro series. However, even that does not make sense—only a pseudomorph of sense. The lode is called a "ledge", which is an unfortunate label for such a form of deposit as that at Randsburg, California. A 'ledge,' is a horizontal shelf; it is a poor word for a vein, lode, or other steeply inclined ore-channel. "The ledge", says our E. M., "is a porphyritic-lime-silicate and contains about 60% of CaO". I think not. Pure limestone, or calcite, contains only 56% of CaO, or lime. 'Porphyritic' is a term that is frequently misunderstood, and therefore misused. It refers to a speckled structure, the original of this type of igneous rock being spotted with snow-white and rose-red crystals of feldspar in a blood-red groundmass. This first 'porphyry' was a beautiful ornamental stone, which the Romans obtained from quarries at Ghebil Dokhan on the Red Sea. It was called 'porphyry' on account of its color, the Greek word *porphyra* meaning purple. However, the idea of structure—of a speckled appearance—now dominates the meaning of 'porphyry'. The Western miner's 'bird's-eye porphyry' is typical of rocks of this class. Next we are told that "the gauge minerals of the lodge near the surface consist of quartz, Sericite, Carbonates and Gypsum". The second word should be 'gangue', of course. This refers to the non-valuable or rock minerals that accompany the valuable or ore minerals in a vein or lode. This word comes from the German *gang*, which means lode. It is a mistake to mix the names of minerals with words that are merely descriptive. 'Carbonates' says nothing; at Randsburg this might include the carbonate of iron (siderite), the carbonate of lead (cerussite), the carbonate of lime (calcite), the carbonate of manganese (rhodochrosite), or the carbonate of magnesium (magnesite).

We must proceed. "A large disseminated gossen", it is stated by the E. M., "is seen at the outcrop and Pyrite (Iron Sulphide) can be found in minute crystals in the disseminations." This kind of language is much more common than is generally supposed. To clear the air it is necessary to say that 'gossan', not "gossen", is a Cornish word; it refers to the oxidized iron-stained cap of a lode, and is equivalent to the German *eiserner hut* or the French *chapeau de fer*. To be disseminated is to be scattered abroad as seed is scattered. *Semen* is the Latin for seed and *dis* means asunder or apart. We have the disseminated copper deposits—vulgarly and incorrectly named 'porphyries'—in which the copper is widely distributed in the form of particles of chalcocite. The word disseminated is applied to the thing that is scattered, not to the thing in which it is scattered. A gossan could be disseminated over a country by a violent explosion; our E. M. does not mean that; he means apparently that the pyrite (with a big P) is widely and uniformly scattered amid the gossan, a mass of iron-stained and honeycombed quartz. A 'dissemination' is a condition, it represents an abstract idea; therefore it can not contain minute crystals, but it might co-exist with minute crystallization. It is a mistake to mix the abstract with the concrete; the result is delirium.

The report continues: "Surface waters containing Chlorine evidently acted on the veins and the values leashed out and carried down to ground water level, here they have participated and formed a secondary enrichment. We have a Horn silver (Parargyrite) plastered in fine specks in the cleavage of the rock." That the surficial drainage of the desert contains chlorine in solution is more than probable. The late William P. Blake wrote on the subject twenty years ago. The chlorine in such water exists usually as sodium chloride, or common salt, and produces silver chloride, a waxen mineral known to miners as hornsilver. That is why prospectors in the South-West are called 'chloriders.' Our friend the E. M. has got hold of some of these ideas, but it is evident that he holds them by the tail, precariously.

The "values" might be "unleashed," by way of metaphor, but he means 'leached,' which also is wrong, because nothing so abstract and unsubstantial as "values" can undergo so concrete a process as leaching or dissolving. He means that the valuable metals, particularly the silver, were dissolved by the chlorinated surficial waters and carried in solution to the line of ground-water, that is, the level at which the water of atmospheric origin stands normally underground. For "participated" we must read 'precipitated,' of course. That is a typographical error, but "parargyrite" is more than that. The mineral hornsilver, or silver chloride, has a scientific name, which is cerargyrite, from the Greek *keras*, meaning horn, and *arguros*, silver. Pyrargyrite is ruby silver, a complex sulphide of silver and antimony. The word is derived from *arguros* and *pur*, fire, in allusion to the color of this beautiful mineral. Specks are not plastered; to plaster is to spread uniformly; he means that the planes of cleavage in the rock are speckled with fine particles of hornsilver, like minute drops of wax. He uses cerargyrite correctly later for silver chloride, and states that it "will be the predominant ore of the precious metals occurring in the oxidized zone." Cerargyrite contains silver only, not gold. A similar blunder is made when asserting that "the silver ore bodies of the Rand district closely resemble those of the Comstock Lode". The yield of the Comstock was nearly half gold and half silver in value, whereas the Randsburg ore is essentially a silver one. This trick of comparing one district about which a writer knows little with another about which he knows less is common. I remember, when in the interior of Australia, at the end of the railroad, meeting a couple of educated young women that had never traveled on a train before. I asked them what they thought of it. "It's just like riding in a balloon," was the reply. They had never seen a balloon, of course. Perhaps the E. M.'s report is merely a *balon d'essai*, a trial blimp into the empyrean of mining finance, inflated with the helium of a wayward imagination, and liberated from the anchorage of fact.

DISCUSSION

An Engineer's Patents

Technicians Who Take Out Patents Probably Commit Fewer Errors of Judgment Than Do Ordinary Inventors—Prior Art Must First Be Studied

THE EDITOR:

Sir—It would be interesting to know just what the circumstances were that impelled you to write the editorial "An Engineer's Patents," which appeared in your issue of July 22, 1922. The article contains much specific advice that nearly anyone having business to do with patents could take advantage of for his own benefit. However, the general purpose of the article, its conclusions, and the impressions which it creates are not in sympathy with the objects and policies of the patent system of the country, and as a whole, if followed by engineer inventors would probably cause them greater loss and injury than if they continued to pursue their aims in the well known and heretofore approved manner.

At a hearing had before the House Committee on Patents, in 1919, the following question was put to Mr. Frederick P. Fish, of Boston, Mass., who is recognized as being the most illustrious exponent of patent matters in the country:

Q. There is an impression among certain people that the inventor of a patent, as a rule, does not get much out of the invention.

A. About that I have much real knowledge, and I venture to deny the proposition. Take it by and large the inventor gets well paid. I mean the individual inventor, sometimes in one way and sometimes in another. He gets well paid, and unless he is an eccentric he is generally satisfied. You must not forget that the very qualities that make a man an inventor are the qualities that make an eccentric. Men imagine that they have made an invention when they have not made one; they often greatly exaggerate the utility and value of their achievements. You must not also forget that not one patented invention in ten is worth making, and that is the reason why many of them are not a success. I have heard it said and believe that four out of five things that are patented today are for worse ways of doing something that is well done already. The man that makes that kind of invention does not recognize that truth at all, and charges to others the failure of inventions which really fail because they have no inherent merit.

At the same hearing, Dr. L. H. Baekeland, of bakelite fame, who has had a very wide experience as an inventor, testified as follows:

There is another element to be considered in the patent situation. I shall have to talk about myself and my own affairs in this particular instance, because I happen to be, so far as I know—and no one has contradicted me as to this—the only man in the United States who started here an important new branch of the coal tar industry.

I took out my first patents for these products in 1907. Since then there is hardly a week, and there is certainly not a month, when there are not one or more patents issued in this country and other countries which are developments or afterthoughts—and very often imitations—of those first patents of mine on these particular synthetic phenolic condensation products.

I can tell you that the same thing exactly occurs in the case of every published patent which amounts to anything. You take the initial patents in wireless telegraphy; they have been followed by endless other inventions and improvements; the telegraph, the telephone, and other great inventions show the same history. There is a kind of impetus given by the publication of a patent which accelerates the thinking and dynamics of a nation. This is an important element in the general benefits of patents that has not been sufficiently brought out in these discussions. The publication of an invention stimulates action; it makes other inventors think and work.

You will appreciate, after reading these excerpts, that your viewpoint is widely variant from that of these parties. As a matter of fact, engineers who take out patents probably commit fewer errors of judgment in respect thereto than does the ordinary inventor who is unfamiliar with the field in which he is working.

After many years' experience in patent matters, I have reached the conclusion that the sanest advice to give to any inventor is, first, do not attempt to effect improvements in any art until you have fully familiarized yourself with what has been done before along the line in which you are interested, and which will largely be revealed by a comparatively inexpensive search through the prior art in the Patent Office. Second, if you have reached a conclusion that the solution of the problem which you have in mind is new, then satisfy yourself that, even if you have effected the desired improvement, it has commercial possibilities. If this advice is followed intelligently, there is no reason why any engineer inventor should meet with the failure which your editorial would lead one to believe is almost bound to occur except in special cases.

Washington, D. C. JOHN BOYLE, JR.

The Mining Law Revision

THE EDITOR:

Sir—I do not like your editorial entitled "The Moribund Mining Law Revision." When you say therein "true it is that this is a government by noise," and by implication attribute the "noise" to the "vociferous minority" who oppose revision, you take what seems to me to be a position not warranted by the facts, as well as begging the whole question. What reasons have you for assuming that the antis are in the minority? And if there has been any "noise" in the matter it certainly has been made more by those who favor revision than by those who oppose it. In fact, the former have been vigorously agitating the subject for half a decade or more, while the latter have been heard from only so recently that some of us began to fear the case would go against us by default.

Let us look into this matter. The move for revision has been backed mainly, as you say, "by expert engineers and geologists." Practically the only voiced opposition has been from lawyers, and a few associations representing mining operators. The prospector and miner

have scarcely been heard from. No effort has been made by Congress to ascertain their views.

A mining law has for its objects, first, to encourage the discovery of mineral wealth, and second, to safeguard capital or effort devoted to development. For over sixty years the existing Federal law has so well promoted both results that the region over which it applies has become the most notable metal and mineral producing area in the world.

But, of late, the blight of bureaucracy has spread over it, discouraging prospecting, adding burdens to the task of the man who is trying to patent his claims, dotting the once free and open West with reserved areas where only leases can be obtained, and doing other things that discourage search. And finally this demand for revision of the law which calls forth the enthusiastic support of all the Washington Bureaus. The campaign has gone so far as to intimate that the prospector is no longer needed, that his work has been accomplished; and to prove this they say "Where is he? He has already disappeared."

Well, yes, he has, very largely, just as he has from other regions where he has to pay a license to prosecute his vocation, and where he is debarred by law from owning what he may discover. And there are many who believe that his partial disappearance in the domain of the Federal Law is a direct result of the activity and "noise" exhibited and made by the revisionists during the last five to ten years.

Denver, Col. THEO. F. VAN WAGENEN.

The Origin of Man

THE EDITOR:

Sir—The article appearing in the *Journal-Press* of July 15, p. 94, by Thomas Smith, on the "Harmony of True Science and True Religion," is a subject of much importance and Mr. Smith has stated some interesting things. He has, however, given the impression that there are no true scientists that set forth that Man originated from the monkey. I doubt very much if there are really any "true scientists" that believe in such a theory, although, it must be admitted that some of those who claim distinction as being advanced students and scientists, proclaim in no unmistakable terms, that Man and monkey are identical in their primary origin. Prof. Knight, of the American Museum of Natural History, in an article appearing in *Popular Science* in June, 1921, says, among other things, that he wrote concerning the Neanderthal Man, "As he stands before us in all his primeval shagginess, grasping his heavy wooden spear in the moonlight—and so I have shown him in my drawing on the opposite page—he thrills us. This is our ancestor; this is the creature from which we evolved; this thing is bone of our bone, flesh of our flesh. We are stirred by *his* passions, urged on by *his* nameless instincts. Forty thousand years separate us from him. But millions of years separate him from still lower animals. He stands close to us—this cunning, fighting, hunting, ferocious Neanderthal Man."

In a recent issue of the *New York Times*, June 15, 1922, Dr. W. K. Gregory, Curator of Comparative Anatomy of the American Museum of Natural History, is quoted as stating at a meeting of scientists that the important thing to the scientific man was classification, and that classification was an important contribution to evolution. He declared that the first step in this study was taken by Linnaeus, "the father of natural history," who put the apes and similar animals into a class called primates. The second step, he said, was taken by Darwin, who said that man belonged to that particular group with the gorilla, the gibbon, the orang-utan and the chimpanzee. He further stated that a vast amount of work had proved Darwin's contention. When we say that man is in this group we do not mean that he is descended from a gorilla or an ape, but from a common anthropomorphous type. The differences are in proportion or degree, but not in kind. The Curator above mentioned leaves no doubt as to his views of Man evolving from some type, from which the monkey and other simians came, and he has made an attempt to show the relationship, by his creation in the Hall of Man, at the American Museum of Natural History in New York City, of several links, which must impress all who see them, as being devised to support the theory of evolution as above expounded. The Piltdown Man, which he reproduces, is half ape, half human. The bust is described as a "restoration."

It is true that not all scientists take the views as they are expressed above. It is also true that scientists are not in agreement with each other. Therefore, it is not surprising that there should be a lack of agreement as between them and those identified with religion. It is plainly apparent that the scientists should first thresh out their disagreements and get a firm basis to stand upon. When they do, I venture the opinion that they will discard the theory of man emanating from a common ancestor as the ape or other simian, and come to the conclusion as expressed by Dana (see p. 573, second edition, 1870, Manual of Geology) "Man is therefore not one of the *primates* alongside of the monkeys; *he stands alone*—the Archon of mammals." *Deus fecit.* JOHN T. REID.

Lovelock, Nev.

Mine Depletion

THE EDITOR:

Sir—I am pleased to note in your issue of June 17th that I at last "got a rise" in response to my articles on "Depletion," and from Mr. H. B. Fernald at that.

Was the intent of the allowance for depletion to return to owners the amount invested in a mine?

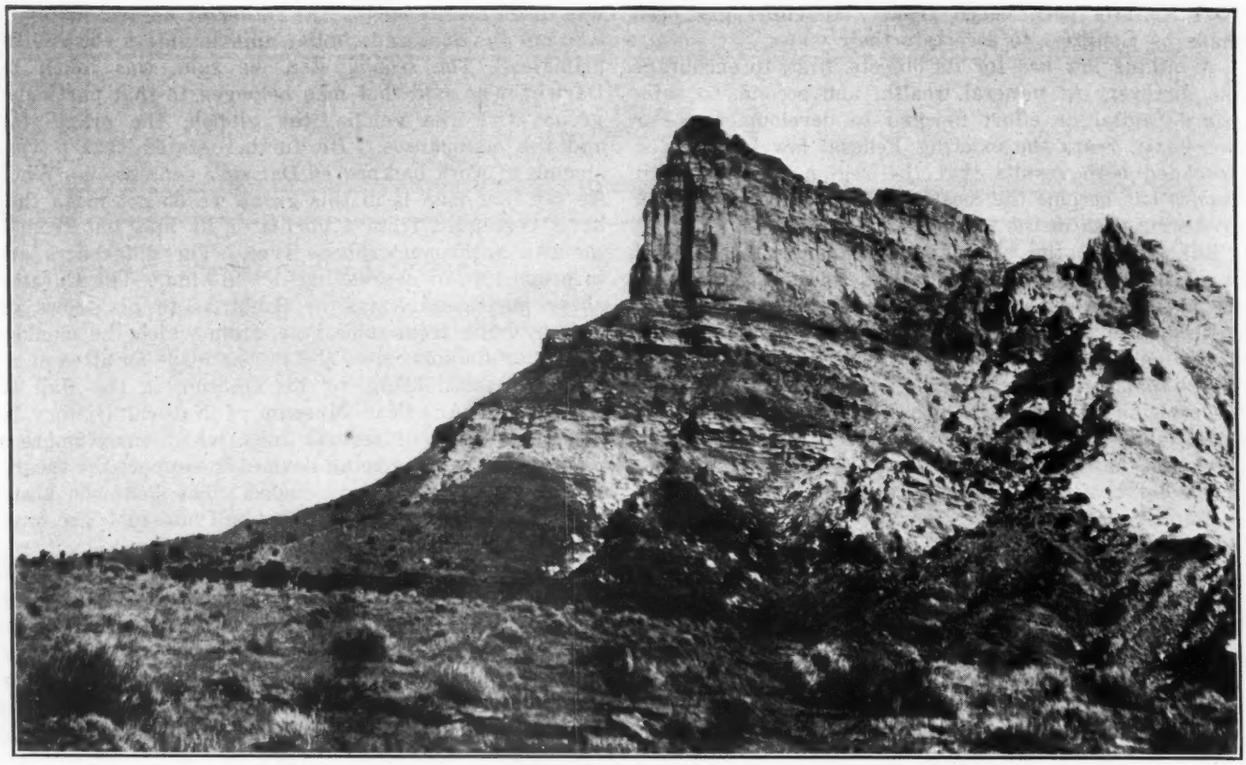
It is very evident from the discussion between Senators Underwood, Smoot and McCumber, quoted by Mr. Fernald, that the Senators had in mind the figuring of profits on real estate, stocks, bonds, etc., purchased prior to March 1, 1913, and sold subsequently, and it is very simple to understand why the value thereof on that date and not the cost should be the basis, but figuring a depletion allowance on a mine is an entirely different proposition.

If the answer to my first question is "yes," is the amount invested what the mine cost, or what it was worth on March 1, 1913?

The man who on March 1, 1913, purchased for $100,000 a mine worth a million dollars was certainly in hard luck for not having bought it a day or two sooner, so as to be able to raise the value for depletion up to a million dollars.

According to the article on this subject by Mr. Russell Bennett in your issue of June 3 the Internal Revenue Department is not having such an easy time guessing value on March 1, 1913, as Mr. Fernald depicts.

New York. C. B. HOLMES.



Temple Mountain, Utah, looking northeast

Uranium-Bearing Asphaltite Sediments of Utah*

Erratic Distribution of Uranium and Vanadium in Deposits at Temple Mountain Makes Special Sorting Necessary—Weathering of Asphaltite and Concentration of Minerals Have Formed Oreshoots—Origin of Shinarump Conglomerates Uncertain

BY FRANK L. HESS

ASPHALTITES[1] carrying vanadium are now comparatively well known, but asphaltites carrying uranium are exceedingly rare, and a sedimentary asphaltite carrying uranium, vanadium, other metals, and metalloids, as do those described in this paper, has been hitherto unknown. The deposits to be described are situated in Temple Mountain, forty-five miles southwest of the town of Greenriver, and at adjacent localities on the eastern flank of the San Rafael Swell, Emery County, in the southeastern quarter of Utah.

The San Rafael Swell is a huge oval dome about forty miles long and twenty to thirty miles broad. Its principal axis is curved and runs about northeast in the southern half and north-northeast in the northern half. At the eastern edge of the Swell the rocks rear suddenly upward, in places to an angle of 60 deg., and then flatten out so that on the top of the Swell the rocks are almost level. The heavy Jurassic sandstones[2] (called La Platta by Emery) and overlying beds have been removed from the top of the Swell by the immense erosion that the country has undergone, but along its southeastern and eastern face the remnants form a huge rampart that is cut through by many washes, some of which are spectacular. Here and there a remnant rises above its neighbors, and the most prominent, known from its form as Temple Mountain, rises perhaps 700 ft. above the general level of the Swell and is a landmark for a large area of country. The upper 300 ft. of the mountain is the lowest bed of the Jurassic sandstones, and the lower part is made up of the Moenkopi (Lower Triassic) red beds at the base, overlain by the Shinarump (Upper (?) Triassic) conglomerate, which is the ore-bearing bed, and above that are the Chinle (Upper Triassic) red beds. The Chinle (as these red beds are denominated by the U. S. Geological Survey) appear to me to occupy the same position as the Dolores red beds in the Colorado carnotite field, but are thinner. The mountain rises steeply to its precipitous crest, which is formed of Jurassic sandstone and which is perhaps a half mile long. For a half mile southeastward the Jurassic sandstone and most of the Chinle red beds have been eroded away.

Gregory[3] describes the Shinarump conglomerate in Arizona as a hard bed, so resistant to weathering that "it is a cliff maker and caps erosion remnants," but

*Published by permission of the Director, U. S. Geological Survey. A more detailed paper will be published by the Survey.

[1]Asphaltite is here used as a term to include all of the hard asphalts.

[2]Emery, Wilson B., "The Greenriver Desert Section, Utah," *Amer. Jour. Sci.*, Vol. 196, 1918, pp. 554 and 564-568.

[3]Gregory, H. E., "Geology of the Navajo Country," U. S. Geological Survey, "Professional Paper 93," 1917, p. 38.

here it is one of the least-resistant beds. Beyond Temple Mountain it has been entirely removed by erosion, and both to the north and to the south it has been washed away to the edge of the Swell, where it is protected by the heavy beds of the Jurassic. The only exceptions are Flat Top, a mountain lying two and a half miles to the southwest, which will be referred to later, and the flat area lying between "The Temple" and the cliffs a half mile southeast. Gregory's description of the bed might have been written at Temple Mountain. He says:

> The Shinarump is everywhere lenticular; lenses of conglomerate overlap lenses of coarse or fine sand, and plasters of pebbles many square feet in area, or long, narrow cobble pavements, appear and disappear within the formation in a capricious manner. Cross-bedding is characteristic; short laminæ meet each other at large angles, and longer beds form smaller angles with the horizon. Angles between 3 deg. and 24 deg. with a prevalent dip of N. 30 deg. W. were measured on the Little Colorado. In many places pebbles are irregularly grouped like raisins in a pudding, and here and there lines of pebbles $\frac{1}{8}$ to 2 in. in diameter simulate strings of beads. Again, a single cobble may be set in the midst of several cubic yards of finer-textured rock.

At Temple Mountain the Shinarump conglomerate is sixty feet thick, and contains many petrified tree trunks, and the stems of fossil plants one to three inches thick having a structure which by one not a paleobotanist would be described as "reed-like." These are in no place petrified, but are lignitized, and they were evidently alive or at least fresh when they were buried in the sands. The tree trunks, on the other hand, were apparently floated to their present positions, for they are rootless and branchless, mostly fragmental, and were in various stages of decay when silicified. A few of the logs are partly lignitized.

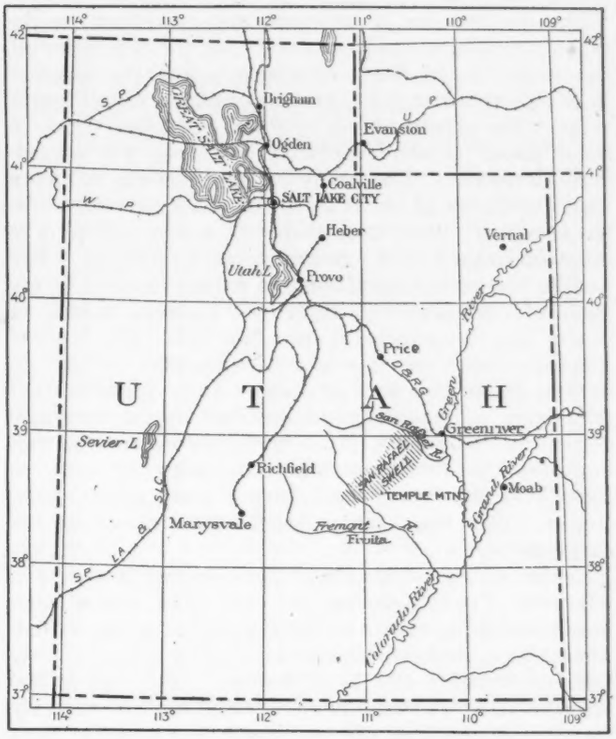
Many of the sandy parts of the conglomerate are here darkened by asphaltic material, in places appearing oily, and the odor of petroleum is easily obtained at such points. The stratum has often been referred to as petroleum-bearing, and there seems never before to have been any question that the petroleum belonged in the bed. The asphaltite is contained in the sandstone as particles ranging from the size of a pinhead to more than two inches in diameter. This material was apparently all deposited when soft, and besides occupying individual spaces like other pebbles it squeezed out between the surrounding sand grains and in places coalesced around them. Where the asphaltite weathers from the sandstone it leaves round cavities, showing that it had been an integral part of the sandstone, and not merely a filling of interstices. The present appearance of the asphaltic material is, however, markedly varied at different places. Where it carries the metals and metalloids it is a glistening black, and in other places it has the brownish color and general appearance of an oil-soaked sand.

White Sandstones Cut Mountain from East to West

Just south of the highest point a body of white sandstone several hundred feet wide cuts east and west across Temple Mountain and reaches from the top almost to the bottom. On the west side of the mountain the body is irregular; on the east it is shaped like a broad wedge; and on both sides reaches below the plane of the Shinarump. At several places in the white rock great dark-brown iron-stained masses may be observed.

The uranium and vanadium deposits are with one exception, to be noted later, in the asphaltites, and are therefore mostly in the Shinarump conglomerate. Beginning with the north side of Temple Mountain, the Shinarump conglomerate carries some bodies of uranium- and vanadium-bearing asphaltite, but long before it reaches the white sandstone it has ceased to carry paying quantities of the minerals, and no more is found for a quarter of a mile beyond the white sandstone. Here the uranium and vanadium are again found in valuable quantities, and on South Temple Wash may be followed almost to the point where the Shinarump conglomerate dips under the floor of the Wash, a distance of one and one-half miles.

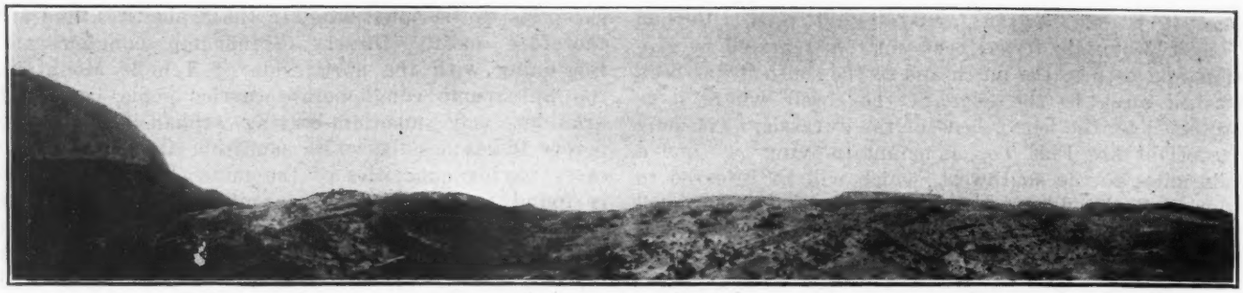
The Shinarump conglomerate is exposed north of Temple Mountain for four or five miles, and is exposed to the south for an even greater distance. Oil stains



Index map of Utah

are shown in the outcrops on the south, but no uranium or vanadium minerals have been found. Last year, uranium and vanadium deposits were found in Flat Top, the small outlier two and a half miles southwest, but Temple Mountain has produced all of the ore that has been marketed. The workings have been mostly on South Temple Wash, a short distance from the point where the Shinarump passes under the débris. On the opposite side of the mountain along North Temple Wash extensive orebodies have also been worked. In the white sandstone interstitial asphaltite deposits carry uranium and vanadium, and far above, in a soft layer of the Jurassic, probably fifty feet below the summit of the mountain, uranium and vanadium are also found.

When the radioactive deposits at Temple Mountain were discovered it was not the asphaltite that attracted attention, but its oxidation products, for oxidation gives rise to a remarkable series of bright-colored uranium and vanadium minerals that would attract any prospector's attention. As soon as the excavations



View across the San Rafael Swell, looking south and southwest from South Temple Wash. Flat Top on the right middle horizon

reach a few feet from the surface, oxidized minerals generally become markedly fewer, but they never wholly disappear.

The distribution of uranium and vanadium in the asphaltite is apparently as erratic as the deposition of the sandstone in the conglomerate, and the ore lies in shoots as distinct as those in ordinary metalliferous veins. The shoots take a peculiar ellipsoidal form, in some places greatly elongated, but they are exceedingly irregular. They may reach a length of more than 100 ft. by 15 or 20 ft. broad and 7 or 8 ft. thick, but they may not be more than 3 ft. x 4 ft. x 6 ft. The ellipsoidal shape seems to be due to weathering. The weathering proceeding from the outside inward leaves cores of comparatively unchanged material, which of course have a rounded form. Just what the original shapes of the orebodies were is somewhat difficult to surmise from the data at hand. It is probable that they were in irregular masses due to the eccentric deposition of the beds. It is hardly to be expected that any orebodies that were laid down with the beds, as these evidently were, could have a much greater continuity than the various parts that make up the conglomerate.

Lenses of fine sand, coarse sand, coarse gravel, and mixtures of all, make up the bed. The coarse sand is commonest, and with it the asphaltite was deposited. There has probably been some migration of the asphaltite within the beds, however, and within the oreshoot itself the uranium and vanadium are unevenly distributed, so that the ore must be carefully hand picked. It would be thought that the ore could probably be easily hand picked by a miner who had once become acquainted with the asphaltite and its uranium and vanadium content, but it has been found that in every new oreshoot new criteria must be worked out for sorting, so that mining has been a constant struggle to know what the ore in hand was carrying.

Variety of Minerals Present

Other oreshoots have been formed through the weathering of the asphaltite and the concentration of the uranium and vanadium minerals in the soft sand left after the removal of a part of the asphaltite. The quantity of asphaltite present is in places large and has prevented other cementation, so that when it weathers out the residual sands are loose and porous and easily worked by pick and shovel. Here and there the hydrous uranium and vanadium minerals uvanite, a uranium vanadate discovered here; rauvite, a calcium-uranium vanadate, also discovered here; carnotite, potassium-uranium vanadate; and hewettite, red calcium vanadate, form in small masses that push the loose sands aside. Among the other hydrous uranium and vanadium oxidation minerals are pintadoite, the dark-green calcium vanadate; pascoite, the orange calcium vanadate; zeunerite, the bright-green copper-uranium arsenate; and perhaps others. A little erythrite, hydrous cobalt arsenate, is also found. Some of the combinations are striking as color schemes. Celadonite, an arsenic-green iron-magnesium-potassium silicate, colors the sandstones in and near the ore deposit at many places.

Besides their unique occurrence in the sedimentary asphaltites of the Shinarump conglomerate, uranium and vanadium are found under equally unusual circumstances in the white sandstone above, to which reference has already been made.

Identification of "Flopover" Difficult

The appearance of the white sandstone is so totally different from that of the neighboring rocks that it was at first difficult to tell what had happened, and it seemed as if a block had been faulted into the space from some unexposed sandstone. It will be seen by the illustration, however, that the red beds can be traced directly into the white sandstone without break, so that the lack of color is evidently due to bleaching. A great mass of the white sandstone extends for several hundred feet south from the mountain, and is known to the miners as "The Flopover." This is so badly broken that little can be told about its structure. Through it are small masses of uranium-bearing ore, some carbonaceous, and some without carbon. Parts of the rock are stained with brownish-yellow uvanite, and here and there are small crystals of bright-green zeunerite. The block is evidently what the miners have considered it, a column of bleached sandstone that has fallen over.

On the southwest side of the mountain the bleaching has spread rather unevenly through the mass. For a distance, however, the red color is entirely removed from both the Moenkopi and the Chinle red beds. At the upper edge of the Chinle is a great mass of iron oxide, much more concentrated than that in the ordinary red beds. It has largely the nodular structure familiar in the pyrite concretions commonly found in sandstones, and is evidently oxidized pyrite. With it and following more or less vertical cracks are masses of carbonacious material forming globular or ellipsoidal masses, but filling interstices in the sandstone. These carbonaceous masses are said by Robert H. Sayre, the engineer in charge, to carry as much as 13 per cent V_2O_5, and more or less uranium. The iron oxide is also said to carry some vanadium. As has been mentioned, about fifty feet below the top of the remnant of Jurassic sandstone is an unusually porous stratum, and here again uranium and vanadium minerals have been deposited with more or less asphaltite, but in general they are comparatively free from car-

bonaceous material. The deposit is from an inch to six feet thick, and was sufficiently rich for drifts as much as fifty feet long to be run in it.

In the débris at the base of The Flopover are masses of sulphur, copiapite (a sulphur-yellow basic ferric sulphate), and halotrichite (iron alum). These, with the bleached appearance of the rock, the oxidized pyrite, the deposition of the asphaltites along the cracks, and the uranium and vanadium deposits high above in the Jurassic sandstone, tell the story of what has happened. Before the country was eroded a hot sulphur-bearing spring, probably due to the same causes that formed the San Rafael Swell, flowed upward along the cracks made at the time the Swell was formed, leached the iron oxide from the Moenkopi and Chinle red beds, changed it to iron sulphide, and deposited it in large masses at the upper edge of the Chinle and in the lowest Jurassic sandstones. At the same time it leached from the Shinarump conglomerate all the asphaltite and its captured metals that were within reach, and carried them upward, depositing a part of the asphaltite alongside the pyrite, but the most volatile products were carried to the surface and lost. The uranium and vanadium were in part deposited with the asphaltite, and in part carried on up to a porous bed in the Jurassic. The soaking out of the asphaltite and the uranium and vanadium extended for perhaps a quarter of a mile to the south of the bleached sandstone, and nearly to the present north end of the mountain.

Incomplete analyses of the asphaltites from the Shinarump conglomerate and from the parts carried upward and deposited in the Jurassic sandstone gave the results in the table following. The "insoluble matter" is that part of the sample left after ignition and treatment of the residue with hydrochloric acid. In a rough way only the material lost by ignition and that dissolved in the acid represent the asphaltite and its contained sulphur, selenium, and metallic elements. In columns 3 and 4 it is considered as 100 per cent asphalt, and the quantities in columns 1 and 2 are recalculated on this basis, although it contains also some

INCOMPLETE ANALYSES OF ASPHALTITES FROM TEMPLE MOUNTAIN, UTAH
W. T. Schaller, Analyst

	1	2	3	4
Volatile matter	49.57	67.11	....	....
Insoluble matter	46.32	26.54	....	....
U	1.13	2.88	2.10 U_3O_8	4.65 U_3O_8
V	.23	1.17	0.43 V_2O_5	2.09 V_2O_5
S	4.98	1.37	9.38	1.87
As	Trace	Trace	....	.....
Se	None found	None found	....	.....

(1) Specimen from Cowboy claim, Shinarump conglomerate. (2) Specimen from lower part o the Jurassic sandstone on the west side of Temple Mountain. (3) and (4) are recalculations of (1) and (2) respectively based on the soluble parts as roughly 100 per cent.

lime from gypsum and from other earthy impurities.

A considerable tonnage of ore shipped during the war averaged about 1.75 per cent U_3O_8 and 4 per cent V_2O_5, strikingly different from hand-picked specimens.

It is surprising that the sulphur in the asphaltite from the Shinarump conglomerate should be so high, though its absorption of sulphur may have been the reason that the asphaltite did not migrate with the hot water. The oxidized minerals and some of the asphaltite give off selenium on heating in a closed tube, and it seems odd that these specimens showed none.

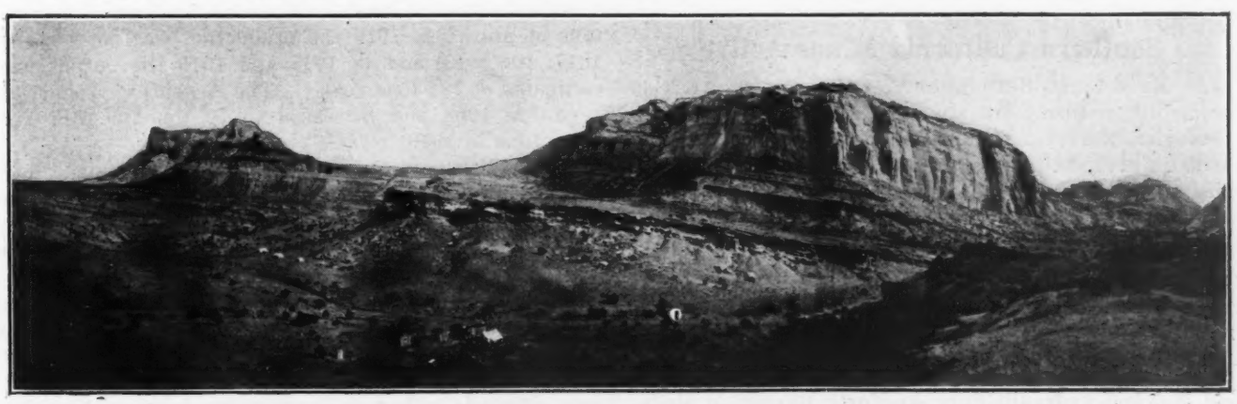
Springs have almost entirely disappeared from the San Rafael Swell, but one that carries to the surface a large amount of hydrogen sulphide and is now depositing sulphur in the limestone beds through which it flows is known on the south bank of San Rafael River about thirty-five miles northeast of Temple Mountain. It is, however, not a hot spring, but it is slightly tepid. Other sulphur springs are said to be found at the north end of the Swell.

Silicified Logs Contained in Conglomerate

As I have said, Flat Top is a flat-topped residual hill two and a half miles southwest of Temple Mountain. The top has a surface of perhaps twenty acres, and is formed by the Shinarump conglomerate, which has in every way the appearance of the same bed in Temple Mountain. The conglomerate contains a large number of silicified logs ranging up to two and a half feet in thickness. Many of the logs are flattened, and most of them were in an advanced state of decay before petrifaction. As at Temple Mountain, they had nothing to do with the precipitation of the uranium and vanadium minerals, and the occurrence of the minerals with the logs is merely fortuitous. Only a small amount of prospecting has been done, and little can now be said of the probable quantity of uranium and vanadium to be obtained, but the outcrops do not seem to be as rich as they were at Temple Mountain.

Robert H. Sayre informs me that there are signs of old hot-spring activity between a half mile and a mile from the hill, but I did not have time to examine them.

The only other known occurrence of uranium in the Shinarump conglomerate is at Fruita, south of the San Rafael Swell. Here for a long while, zippeite, the hydrous uranium sulphate, has been known to occur in small quantity. When I visited this locality in company with B. S. Butler in 1913 only a few specimens containing a small quantity of the mineral could be found. Last fall, while I was at Salt Lake City, two prospectors showed me a small specimen of uranium-



Temple Mountain, on the San Rafael Swell, Utah. Camp of the Chemical Products Co. in foreground and radium workings in right middle ground

bearing asphaltite that they said they had obtained from further tunneling at Fruita, and it is probable that the deposits belong to the same series as those at Temple Mountain and Flat Top.

Origin of the Ores Puzzling

The origin of uranium and vanadium in the Shinarump conglomerate is exceedingly puzzling. If the origin of the Shinarump conglomerate itself were known the information might help to solve the problem. The great quantity of petrified driftwood, and the presence of many lignitized reed-like plants and decaying logs, precipitated uranium and vanadium with other metals from extremely dilute solutions in a shallow sea. It seems possible that an asphaltite may have done the same thing, but the wet asphalts, if I may use such a term—those which contain a considerable quantity of volatile material—carry no uranium and vanadium; at least nowhere do they carry enough to make even a stain on the rocks. The suggestion arises that perhaps only that asphaltite which absorbed these elements became hard quickly, and the physical difference between the asphaltites may be due entirely to the fact that a part was exposed to and picked up the uranium, vanadium, and other elements, and that those parts of the asphaltites which did not pick them up remained unhardened for a longer time and were less altered.

The suggestion is also forced upon one that the hot spring which invaded these rocks may have brought in the uranium, vanadium, and other metals and metalloids, and that from it the asphalt may have derived its metallic content. If these minerals came from the hot spring, then it would be expected that hot springs in other places along the Swell would have deposited some of the rarer metals, but this we do not find. No evidence is known that the spring which still flows on the San Rafael River and the springs which are reported as flowing and depositing sulphur at the north end of the San Rafael Swell have deposited any unusual minerals. Reasoning from the analogy of the carnotite beds, it seems probable that the uranium and vanadium, the selenium and the arsenic, were laid down with the asphaltite, and that possibly a more or less evanescent sheet of water held the elements in solution from which the asphaltite extracted them. Where the veins whose weathering fed the elements to the water were situated there is at present little indication, except that they may have been somewhere to the south, from which direction the rock pebbles and sand, in part at least, seem to have come.

Southern California Mines Active

At Randsburg, Kern County, Calif., active work is going on in thirty-five shafts according to the U. S. Geological Survey. The Yellow Aster is using diamond drills in prospecting its ground. Twenty stamps of the mill are dropping. There has been excitement over a strike in the Mizpah mine, near Johannesburg. The two great mines in Nevada County, the North Star and the Empire, one of the most productive quartz-gold mines in the state, continue steady production. At the Bullion mine the 1,500-ft. shaft has been unwatered and a crushing plant is to be installed. The Spring Hill, adjoining the Golden Gate, is to be reopened. At the old Malakoff hydraulic mine, at North Bloomfield, drifting is now being done and high-grade gravel has been found. In a winze at the end of a long tunnel in the Gold Lead mine, at the same place, gravel carrying many nuggets has been found. The dredge that has been working for the last four years in the American River below Applegate, Placer County, has been moved up the river to Bodfish Canyon, near Weimar. The Independence drift gravel mine, four miles northwest of Foresthill, has been bonded and the bedrock tunnel is being extended.

In San Bernardino County, the California Rand silver mine and its leases continue to be productive and much development and prospect work is being carried on. The ouput of silver by this group of mines is steadily increasing. Gold mining in San Diego County has been inactive for some years, but a few of the old mines in the Julian district are now being reopened and a concrete highway is being built into the old camp. At Descanso the McDougal mine is being reopened by a company that has recently purchased the property.

Mica From South America

By Kirby Thomas

The imports of mica from South America prior to 1914 were practically negligible, relatively and as an item of trade exchange, but the war stimulus directed attention to the possibilities of securing regularly a part of the large imports of this special raw material from this new source of supply. The principal South American countries which are known to have available deposits of mica of desirable quality and size for import are Brazil and Argentina.

In Brazil the deposits, mainly located in the contiguous states of Bahia, Goyaz, Minas Geraes, and São Paulo, are extensive and are now fairly accessible to railroads for transport to the ports. The quality is good and compares well with the Indian mica. Some of the large plates are 20 in. by 10 in., and large supplies, 6 in. by 6 in., are procurable. In the interior province of Goyaz, mica is so plentiful that the natives have used it for window panes from time immemorial. The output of the Brazilian mines is steadily increasing. The proportion coming to the United States has always been large and is becoming greater. There is a prospect of a steady and increasing supply of good mica from Brazil.

The Argentine mica deposits are mostly in the mountain provinces of Cordoba and San Luis. They are not systematically developed and the shipments so far made have not been of so good a quality as those from Brazil. The output of Argentina may be increased.

Brazil produced from 1902 to 1913 about 113 short tons of mica. In 1916 the production was 59 tons; in 1917, 106 tons, and in 1918 and 1919 the output was estimated at 135 tons yearly. The Argentine production began in 1908 and increased to 70 tons in 1917 and to 80 tons in 1918.

Small shipments of mica from Peru were made during the war and irregular shipments have come from Guatemala for a number of years. The product of the latter country has a green shade and is not so desirable for some purposes as other grades in the market.

South American mica must compete with Canadian and Indian products in the United States market, but as the domestic production and prospective domestic supplies of mica are quite inadequate to meet the American demands either in quantity or in special grades, there should be a good market for it in this country.

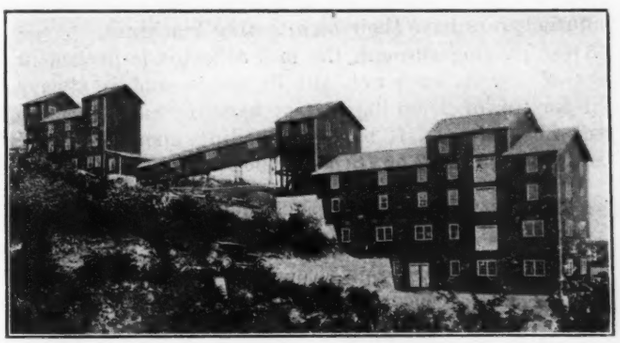
The Marketing of Asbestos

American Demand Largest for Low-Grade Materials; Foreign for High-Grade—New York and Hamburg Chief Distributing Centers —Competition Mainly Between Canadian and Rhodesian Grades

BY B. MARCUSE
President, Asbestos Fibre Co., New York

THE ASBESTOS of commerce is a silky, hard and dense non-metallic mineral. It is not affected by heat and only to a small extent by acids. Without it many arts and industries would be severely handicapped. It is found in various parts of the world, the chief source being Canada, and in no two places is it precisely alike, as an examination of over 500 specimens from all parts of the world, in a collection that I have made during the last twenty years, shows. Besides Canada, the main countries in which it is found are South Africa, including Rhodesia, and Russia. It occurs in practically every state of this country as well as in Australia, China, and parts of South America, but the best and most favorably known asbestos is found in Canada, the African mineral, chiefly Rhodesian, ranking next.

The uses of asbestos are numerous. Among the most important are spinning and weaving asbestos textiles. The best brake lining for automobiles is made of the long grades of Canadian fibers and crudes. Asbestos is used for filtering acids, insulation, such as boiler and pipe covering; fire-proofing, theater curtains, packings, millboard, and asbestos paper. Asbestos roofing manufacturers and the paint trades use it to a large extent as a base. Artificial floors are sometimes made of it.



An asbestos mill in the Quebec district

The chief marketing points are New York and Hamburg. Before the war, Hamburg was the more important. During the war, however, the Central Powers being shut off altogether, New York obtained the lead, and today most of the producers have their offices in New York, though many of them have branches or agents in Hamburg and other large centers in Europe.

The annual consumption of asbestos increased largely during the war, but within the last two years has dropped off considerably. Records of production and consumption of countries outside of Canada were never kept before the war, and thereafter the total production was kept only as regards Africa. It is stated that in 1920 Rhodesia produced 18,823 tons; in 1921, 19,529 tons. How much of this material was actually consumed it is difficult to state. The following table will give some idea of the Canadian output and sales for the preceeding ten years. In this table, the word "Asbestic" refers to asbestos sand:

OUTPUT AND SALES OF CANADIAN ASBESTOS 1912–1921

	Output Tons	Sales Tons	Sales Value
1912 Crude	4,749	5,663	$890,351
Mill stock	98,010	105,898	2,227,221
Total asbestos	102,759	111,561	3,117,572
Asbestic	.....	24,740	19,707
1913 Crude	5,025	5,660	989,162
Mill stock	127,539	131,291	2,841,747
Total asbestos	132,564	136,951	3,830,909
Asbestic	.....	24,135	19,016
1914 Crude	4,062	4,148	773,193
Mill stock	103,607	92,394	2,119,073
Total asbestos	107,669	96,542	2,892,266
Asbestic	.....	21,031	17,540
1915 Crude	3,987	5,370	1,076,297
Mill stock	102,572	105,772	2,476,869
Total asbestos	106,559	111,142	3,553,166
Asbestic	.....	25,700	21,819
1916 Crude	5,415	5,886	1,866,969
Mill stock	112,832	127,553	3,332,828
Total asbestos	118,247	133,439	5,199,797
Asbestic	.....	20,710	29,072
1917 Crude	6,268	5,383	2,748,071
Mill stock	135,475	130,119	4,435,028
Total asbestos	141,743	135,502	7,183,099
Asbestic	.....	18,279	47,284
1918 Crude	4,313	3,692	2,478,363
Mill stock	129,143	137,770	6,458,441
Total asbestos	143,456	141,462	8,936,804
Asbestic	.....	16,797	33,993
1919 Crude	4,065	3,928	3,214,022
Mill stock	153,507	132,837	7,695,430
Total asbestos	157,572	136,765	10,909,452
Asbestic	.....	22,471	65,917
1920 Crude	4,098	3,894	3,811,762
Mill stock	165,348	174,723	10,922,837
Total asbestos	169,446	178,617	14,734,599
Asbestic	.....	20,956	57,602
1921 Crude	3,082	898	632,839
Mill stock	93,153	65,425	4,052,730
Total asbestos	96,235	66,323	4,685,569
Asbestic	27,474	24,084	121,483

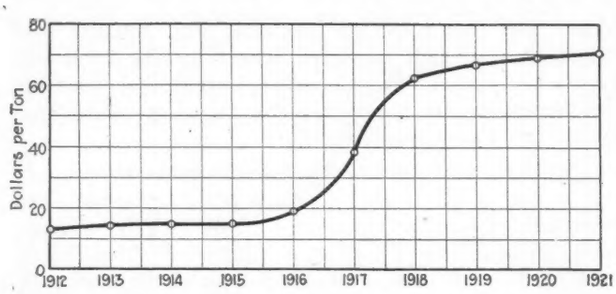
The maximum and minimum demand cannot be estimated, and there are no seasonal requirements.

STANDARD TESTING MACHINE USED

Market requirements cover length, color, and chemical composition, the most important specification being the length and strength of the material. The length is important, as brake linings and textiles require the longest grades, whereas insulating materials, such as boiler cement, artificial flooring, and stucco, use shorter material. A method has been worked out whereby a standard test can be made. The test is performed on what is known as a "standard testing" machine, and is used by most of the mines. Many of them, however, do not classify their material alike or sell on the basis of the same test, so that one mine may make, say, a paper stock that will prove, upon being tested, to be considerably different from that made by a neighbor.

The standard testing machine is a nest of shaking screens and consists of four boxes, the three top ones containing screens and the bottom box a receptacle for the sand or short fibers that fall through the first three. The top box of screens is 2 mesh, 11 gage; the second box 4 mesh, 17 gage; and the third box 10 mesh, 20 gage. The wooden trays or boxes are 5 in. x 16 in. x 26 in. in dimensions.

The material is placed in the top box and shaken for two minutes at 300 revolutions per minute. After shaking, the residue in each box is weighed and the total weight of 16 oz. is accounted for. The long fibers naturally stay on the screen having the largest opening and the short material drops through from the top to the second, and from the second to the third, and the shorts go into the bottom box. The more fiber found in the first box the longer the material and therefore the more valuable the grade. Therefore, if a buyer asks



Curve showing the averge price of all grades of asbestos, 1912-1921

for a material testing 0-8-6-2, which figures together total 16, he will receive asbestos containing 8 oz. of fibers on the second box, 6 oz. on the third box, and 2 oz. of shorts. In this case 50 per cent of the material is long fiber, 37½ per cent is medium-grade fiber, and 12½ per cent is shorts. Another fiber might test 2-8-4-2. What is commonly known as paper stock may test 0-0-10-6; then again what is known to the buyer as cement stock may test 0-0-5-11.

Many Grades of Asbestos Marketed

Asbestos fiber is divided into various grades and must not be confused with asbestos crude. Crude material is known as hand-cobbed crude and does not go through the mill at all. Crude is divided into two grades, Nos. 1 and 2, depending upon length. Fibers are divided into long-spinning fiber, medium and compressed-sheet fiber, pipe-covering fibers, shingle stocks, asbestos paper and millboard stock, cement stock and shorts. The average test on fibers may be taken as follows:

Long spinning fiber	2–8–4–2
Medium spinning and compressed sheet fiber	0–8–6–2
Pipe-covering fibers	0–5–8–3
Shingle stocks	0–1½–9½–5
Paper and millboard stocks	0–0–10–6
Cement stocks	0–0–5–11

Shorts are not sold on length, but according to color and cleanliness. The color of the material varies in different districts, that found at Thetford Mines being much lighter than that from Black Lake, both districts being in Quebec within a short distance of each other. The color, however, is not a prime factor.

There are two important kinds of asbestos, chrysotile and amphibole. A typical analysis of chrysotile is as follows: Silica, 41.40 per cent; alumina, 1.01; ferrous oxide, 1.63; magnesia, 42.01; and water of hydration, 14.21.

An analysis of amphibole, taken from a sample of the Italian variety, is as follows: Silica, 57.72 per cent; alumina, 0.53; ferric oxide, 0.60; ferrous oxide, 2.20; magnesia, 22.61; lime, 13.84; soda, 0.50; potash, 0.30; and water, 0.81.

Impurities are found in the material and are eliminated in a mechanical way only. Iron is picked up by magnets and the material passing over a belt is cleaned as well as possible by hand.

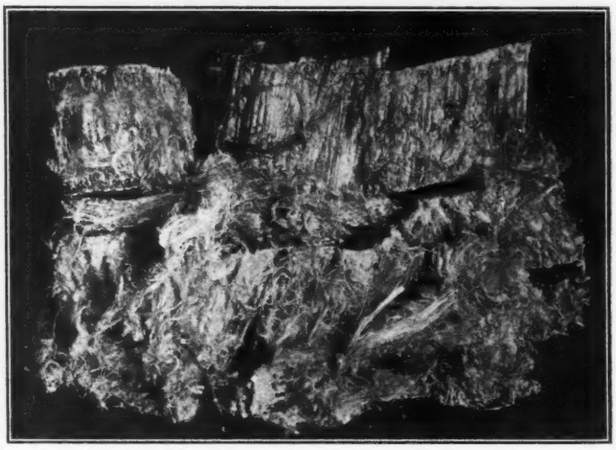
The Canadian asbestos industry is controlled by a few companies and is in a district about thirty miles long, comprising the Thetford, Black Lake, East Broughton, Coleraine, and Robertson areas. Outside of this district are the Danville mines, owned by the Johns-Manville Co. One or two of the mines in Thetford and East Broughton are owned by manufacturing companies in this country, which consumes most of the production of their own properties.

Prices Undergoing Readjustment

At the moment, prices are depressed and much below those which were in effect during the war. This, in my opinion, is only temporary and is caused mainly through the large stocks of raw material on hand after the war and the small demand for manufactured goods. When the business depression has passed, the demand for manufactured articles will soon take care of stocks of raw material with the manufacturer, and then prices will again become firm, as stocks at the mines are not large.

Asbestos is handled in lots of from one ton upward by the miner and redistributed by dealers or agents. No premiums or penalties are allowed, and the material is sampled by the buyer solely by sight and on test given to him by the mines, although some of the large manufacturers have their own testing machines.

After passing through the mill asbestos is packed in bags of 100 lb. each net, 101 lb. gross, and is always sold per ton of 2,000 lb., cost of bags included, in most cases f.o.c. mines. It bulks, depending upon length of fiber, from 60 to 90 cu.ft. per 2,000 lb. It is subdivided



A sample of crude Canadian chrysotile asbestos

into three classifications for shipping: crude, fiber, and sand. The minimum carload for crude and fiber is twenty tons; sand, thirty tons. Sand is also sold in bulk in this country. The value is computed solely on length of material, and terms of settlement are usually 2 per cent ten days, net thirty days.

The average value per ton for a period of ten years, 1909 to 1919, rose from $26 to $80, and the total value from a little over $2,000,000 to $10,000,000. Total rock milled increased from less than 1,000,000 tons to over 2,500,000 tons for the same period.

After the war, prices of asbestos fell rapidly, as did

those of most other commodities. Today's prices compared with pre-war prices may look rather high to the buyer, but he must take into consideration the fact that supplies and labor costs during the war were about three times what they were before the war and today are still 50 per cent higher than they were at the beginning of the war. The average selling prices today are as follows:

	Per Ton
Crude No. 1	$750
Crude No. 2	400
Long spinning fiber	300
Medium spinning and compressed sheet fibers	175
Pipe covering fibers	100
Shingle stock	65
Paper and millboard stock	30
Cement stocks	14
Floats or shorts	8

Individual Grades Prevalent

The consumption of raw asbestos among the paper and millboard manufacturers in this country and the shingle manufacturers here and abroad consumes practically all the short material up to and including that valued at $70. Germany and England use, however, a larger proportion of the fibers and crudes than does the United States.

Materials are sold under distinctive marks. Crude is sold as a rule as No. 1 and No. 2. The most common marks of fiber are X, XX and C, although two mines might make the same mark under an entirely different test; for instance, C from Black Lake is a long fiber, whereas C from Thetford is a short fiber, and another mine in Thetford makes a C known as paper stock.

The industry would benefit greatly if there were a central selling organization, similar to that of the copper companies, to market asbestos fiber. There is a Mine Owners' Association, but not all the mines are members.

The new uses of asbestos which are found from time to time have not been of such importance as to cause any radical change in the demand for raw asbestos, and little has been done by the miners themselves toward making it worth while for chemists and others to busy themselves in finding new applications for this exceedingly useful commodity.

Tigre Mining Reports Decreased Costs for 1921

That the cost of mining is decreasing in Mexico, as elsewhere, is illustrated by the record of the Tigre Mining Co. for 1921, which states that political conditions have been more satisfactory than at any time during the last ten years. No revolutionary parties and practically no bandits have operated in the Moctezuma district during 1921. The production tax has been greatly reduced, due to the operation of the sliding scale based on silver quotations, and was removed during part of the year. Labor has been plentiful and efficient in the district.

The drop in the price of silver was partly offset by greatly decreased costs. Wages were reduced 10 per cent, prices of supplies dropped 20 per cent, and the cost of power 2 per cent. Development was curtailed 12 per cent and construction 60 per cent. Efficiency, as indicated by the tons per man shift, was increased 17 per cent. Marketing costs and losses dropped 41 per cent. These various factors effected marked reductions in all items of expense. Costs were the lowest since 1916.

Following is a comparison of the costs for 1920 and 1921:

	—Costs per Ton— 1920	1921	Per Cent Reduction
Development	$2.56	$1.85	28
Mining	4.48	3.26	27
Milling	3.75	3.15	16
General	1.44	89	38
Marketing	12.31	7.31	41
Total	$24.54	$16.46	33

Following is a comparison of the different items entering into marketing costs for the years 1920 and 1921:

	1920	1921
Deductions on gold	$12,592.80	$10,143.86
Deductions on silver	140,657.43	87,966.48
Deductions on copper	23,476.90	20,336.18
Deductions on lead	50,192.61	35,533.17
Smelter treatment	46,059.03	62,680.10
Zinc and antimony penalty	18,746.99	20,547.69
	$291,725.76	$237,207.48
Railroad freight	106,838.55	83,249.79
Wagon freight	104,855.50	79,090.21
Commissions	15,662.55	9,844.64
Expenses	52,804.28	22,337.39
Totals	$571,886.64	$431,729.51

The mine produced 75,243 tons of ore, assaying gold 0.21 oz., silver 39.30 oz., copper 0.38 per cent, and lead 1.23 per cent. The gross value was $2,331,923.82, or $30.99 per ton. The total production to Dec. 31 has been: Ore mined 863,497.19 tons, concentrate and shipping ore 63,996.67 tons, bullion 290 tons.

The 863,497.19 tons of mine ore produced to date has contained 205,629 oz. gold, 33,873,648 oz. silver, 4,744,855 lb. copper, and 17,026,192 lb. lead, with a gross value of $29,555,747.88.

The mill produced 6,346.27 tons of concentrate, assaying gold 2.39 oz., silver 440.16 oz., copper 4.07 per cent, lead 13.7 per cent, and zinc 21.5 per cent.

Due to the opening of the copper mines, labor will probably be less plentiful than last year, and therefore less efficient. Materials should be slightly cheaper. The production tax will be higher on account of the removal, last August, of the tax-free provision on silver. Treatment and freight should both be lower. Taken altogether, costs should continue practically unchanged, if the price of silver remains as at present.

During the past year, 75,243 tons of ore was treated in the concentrator. The production from the mill was as follows:

	ASSAY			CONTENTS	
	Tons	Gold	Silver	Gold	Silver
Sorted high grade	574.25	2.74	345.63	1,575.68	198,478.60
Table concentrate	2,216.90	4.03	421.24	8,946.79	933,836.40
Re-treatment concentrate	3,555.11	1.30	467.27	4,617.62	1,661,005.14
Total	6,346.26	2.39	440.16	15,140.09	2,793,370.14

The combined product assayed 4.07 per cent copper, 13.7 per cent lead, and 21.5 per cent zinc. The extraction was 96.5 per cent of the gold, 94.5 per cent of the silver, 90.2 per cent of the copper and 94.1 per cent of the lead, a combined extraction of 94.7 per cent of the gross value. The ratio of concentration was 12.28:1. The concentrator operated 97.7 per cent of the total time.

The milling cost was $3.15 U. S. currency per ton of ore as against $3.75 for 1920. A reduction in costs was made in all departments; the greatest reduction was 19 per cent, in the re-treatment department. The power consumed in the re-treatment department was 7.7 kw.-hr. per ton of ore as against 13.25 kw.-hr. for 1920.

It has been proved in the laboratory that the metallurgical extraction is not impaired by a coarser product from the tube mills. This will mean a further reduction of power consumption in the fine-grinding department for the ensuing year.

Mechanical Sampling of Ore

A Discussion of Studies and Tests Made With View to Securing Accuracy Through Standardizing Operations—Results in Three Mills Prove Erratic—Certain Standards for Base- and Precious-Metal Ores Proposed

By Charles D. Demond and A. C. Halferdahl

THE ACCURATE SAMPLING of ores is accomplished when a standard system of operations has been established in accordance with fundamental principles. This article presents the results of tests and studies made with a view to the establishment of such a system.

Sampling mills vary widely, both in the percentage of ore taken as a sample at the different stages of cutting and in the sizes to which crushing is done. For this reason it is often difficult directly to compare mills and decide which of several schemes is best. To overcome this difficulty the following equation can be applied, with proper evaluation of the constants, so that it closely represents the practice in any particular plant:

$$W = kD^a$$

Here W is the weight of ore, D is the diameter of the largest particle, and k and a are constants. This equation is further explained later. By its use the weight of ore corresponding to any size of crushing may be calculated. Such calculations have been made for a number of mills in order to put them all on the same basis as to sizes of crushing. The corresponding weights at selected sizes are shown in the table on p. 283. The examples in this from the Bureau's technical paper, include all giving sufficient data to permit the calculations.

The mills for which excessively large quantities are indicated at four inches do not begin sampling at as coarse a stage as this. The significant fact in these cases is that too large a factor is used for the reduction of weight as the size becomes smaller. The result is that if the rule is continued to an assay pulp of 0.1 mm. fineness (150 mesh), we come to ridiculously small quantities—0.06 gm., 0.0002 gm. and 0.05 gm., respectively, in mills *G*, *W* and 8. While it is well understood that the actual work of preparing the pulps in the bucking room is conducted on a different basis than that in the mill, the figures given in the last three columns of the table show clearly the trend of mill work. Discussion of the figures given is justified by practical experience in determining the correct procedure for ores with which we have worked. The evidence is given later.

Practice at Different Plants Varies Widely

Striking differences are sometimes found in ideas as to sampling an ore. For example mills *H* and *P* represent two different practices on ore from the same mine. At the 4-in. stage, *P* takes as a sample three times as much as does *H;* at 1 in. it takes nearly 20 per cent less than *H;* and these differences become more and more marked with finer sizes. Mill *H* indicates 890 gm. (30 assay tons) for assay of 150-mesh pulp; while the figure for *P* is less than 3 gm. (0.1 assay ton). The former mill seems to take too small a sample at the coarser stages, and the latter too little at the finer sizes.

Mills *L* and *N* both report excellent results on rich spotty gold ores, received in frequent shipments from the same district. To quote the designer and operator of mill *N*, at least one reason for his very large quantities was "to satisfy the sellers, who believed in large samples."

A frequent plan in the original design of mills is to take 20-per cent cuts at each stage and make a 50-per cent size reduction between one cutter and the next. But this procedure is often modified after the mill has been operated for a few weeks or months. For example, mill *F* seems to have originally crushed to 3 in., 1½ in., ¾ in. and ⅜ in. successively, but later changed to 2½ in., 1¼ in., ¾ in., and ⅜ in., thus improving the work at the coarser stages. The designer of mill *L* considers the rule of 50-per cent reduction in size to be suitable for average ores. This mill may have begun on that basis, but finally adopted 2 in., 1 in., ⅜ in., and ⅛ in., which placed the emphasis on care at stages approaching the final assay pulp. Even now the former mill occasionally has a difference of 0.7 per cent lead on duplicate samples which should check within 0.2 per cent.

The practice in some mills approaches more closely a uniform rule than in others. This is clearly seen in the following figures, which compare the actual weights with those calculated from the equation by using the same actual weights:

	Sizes, Inches	Actual Weights, Pounds	Calculated Weights, Pounds	Ratio of Actual to Calculated
Mill *D*	2½	20,000	20,000	1
	1¼	4,000	4,000	1
	⅜	800	800	1
	⅛	160	160	1
		Average		1
Mill *S*	3	10,000	9,170	1.09
	1	1,000	800	1.25
	¼	100	172	0.58
	⅛	10	7.9	127
		Average		105

As to weights, each of these mills is strictly systematic; as to sizes, *D* is wholly systematic, but *S* is erratic. Similar differences occur in the mills quoted from the Bureau of Mines' report.

While the results quoted below indicate that much accurate sampling is done, some of the work is poor:

	Sample Silver, Oz.	Re-sample Silver, Oz.	Difference, Per Cent
Ore *A*	0.34	0.33	3.3
	2.17	2.20	1.4
	1.00	1.25	25.0
	Gold, Oz.	Gold, Oz.	
Ore *B*	2.23	2.22	0.4
	2.48	2.41	2.8
	(a) 0.972	(a) 0.975	0.3
	0.71	0.78	9.9
	1.70	1.84	8.2
	Copper, Per Cent	Copper, Per Cent	
Ore *C*	2.56	2.57	0.4
	7.95	7.90	0.6
	7.27	8.27	13.8

(a) In this case the "sample" result is the true average of three lots, while the "re-sample" was made by re-running the three lots through the mill in succession.

In the example *A*, ten out of eleven comparisons gave checks as close as the first two, but the last set resulted in the large difference of 25 per cent. In example *B*, fifty sets resulted in good checks such as the first three examples; but the last two sets here are

not good checks for gold. As for *C*, the first two sets are good checks; but the third, with a difference of about 14 per cent in the value, is poor.

The above facts show a diversity that emphasizes the need for standardization.

Mechanical Manipulation Is Important

In mechanical sampling it is intended to take a great many small cuts, distributed uniformly through the lot of ore. Since theory and experience both show the importance of this uniform distribution, the matter must not be left to chance but needs to be carefully considered in the design and construction of mills. There must be a steady, continuous flow of ore to each cutter in order to carry out this idea, as any sampling machine necessarily delivers its cuts intermittently. The commonest means for changing this irregular supply into a steady flow to the next cutter is the shaking pan feeder. If the latter is 6 ft. long and has a slope not exceeding 2 in. per ft., the successive portions of ore coming to it spread well, and the desired result is obtained. Comparatively short pans do fairly well if the feed is not allowed to "shoot" rapidly along the pan. The feed spout should deliver the ore to the pan in a direction slightly up-hill. If this cannot be done, a baffle may prevent "shooting." In mills where this intermittent flow exists, it frequently happens that from one to as many as six cuts in succession from one sampler contributed nothing to the next sampler. This gives the work something of the quality of mere grab sampling.

Samples Are Frequently Unduly Small

The worst result of the failure to get ore into a cutter every time it passes beneath the spout is that less than the intended weight of final sample is obtained. In one mill the weight varied from 62 to 91 per cent, averaging 81 per cent of the intended weight. In another case it varied from 26 to 97 per cent with the low average of 57 per cent. The chief reason for the higher result in the first mill as compared with the second probably is that it had fewer missed cuts, on account of taking them more frequently—38, 54, 64 and 70 per minute at the different stages, which average one-third greater than the 21, 35, 45 and 71 cuts per minute in the other mill. The speed should not be increased to the point where a marked "batting" action occurs.

All of the mills from which unsatisfactory results have been quoted appear to be subject to missed cuts, and therefore short weights.

Mixing Is Essential

The revolving drum is an excellent device for regulating feed. When equipped with internal lifting blades, this is an effective mixer. The following results of tests show how much more thorough the mixing is in drums than in shaking pans. Coal and galena, in 1-in. pieces, were dropped into a drum while running on 1-in. pyritic copper ore, the coal being lighter and the galena heavier than any mineral in the ore. The deepest part of the ore bank was 2 in. thick. Twenty-eight portions of the ore entered the drum every minute. The time for the coal to travel 4½ ft. varied from 38 to 82 sec., averaging 60 sec., while the galena varied from 45 to 127 sec., averaging 72 sec. Considering these facts it is probable that the ore dropping from the lower end of the drum at any moment is a mixture of three or four cuts from the preceding sampler. It is therefore easy, with proper speeds, to make sure that every cut from one sampler shall contribute a due proportion to the following sampler. A test with coal and galena was made on a pan feeder 36 in. long, sloping 2.7 in. per ft., and running with a ¼-in. stroke at 360 r.p.m. The pan received forty-three portions of ore per minute, in such a way as to produce a continuous flow. The coal traveled 30 in. in 5.0 to 5.6 sec., while the galena took 5.6 to 6.2 sec. Three-fourths of the test pieces of either mineral, when fed to the pan in groups of six or eight at a time, maintained the same positions, relative to one another, all the way down; whereas, in the drum there was not this noticeable holding together.

A further test was made in a drum by hand feeding high- and low-grade ore alternately with the same frequency that ore is received in regular operation, and in the same amounts. Fifteen successive cuts from the following sampler were caught and assayed. Though the two feed materials contained respectively 23.8 and 68.6 per cent insoluble yet the discharge samples varied only from 44.4 to 51.5 per cent. The variation in quality of feed was much greater than is ever likely to occur in practice; but a more severe test was made by feeding nearly four times as much per minute as before, putting in three portions of the low-grade ore in succession, followed by three of the high-grade, and continuing this alternation. Fifteen successive cuts from the following sampler gave a total range of insoluble from 39.0 per cent to 58.6 per cent; showing considerable mixing even under these conditions.

Strictly mechanical sampling often stops at ½-in. or coarser sizes. If it is continued to ⅛-in. size, less hand work remains to be done, and the chances of personal error are thereby lessened. A most important principle in sampling is to take a sufficient quantity at each stage of crushing; and, as a rule, a sample taken at one stage should be further crushed before the quantity is again reduced. It is, however, a common practice at the beginning of hand work to cut down the quantity without grinding. This may yield too little ore to make an accurate sample.

Riffles Demand Intelligent Use

The best device for reducing the quantity by hand is a good riffle; but this is by no means "fool proof." When the ore is poured rapidly, it is likely to choke in the spaces that discharge toward the operator, and then overflow into the opposite spouts. This action is likely to affect the assay quality as well as the weight of the sample. In addition to pouring slowly, the best safeguard, when there are actual spouts in both directions, is to build the riffle so wide that the ore does not strike the sloping bottoms of the spouts near their upper ends. The danger of running over is also lessened if the upper end of the slope is turned to the vertical position.

To facilitate the determination of the best procedure for sampling attempts have been made to express the weight required at any stage of crushing as a function of the diameter of the largest particle. Indeed, all mill procedures assume that this can be done.

If we had an ore consisting of 2-in. cubes of clean gangue together with similar cubes of galena, and could crush this so that nothing but 1-in. cubes resulted, there would be eight times as many particles after

crushing as before. For equal precision of sampling it is necessary to take only the same total number of particles of the 1-in. ore as of the 2-in size, which gives, by weight, one-eighth of the former quantity. That is, the weight is proportional to the cube of the diameter, or

$$W = kD^3$$

Where W = weight of ore
k = a constant
D = diameter of the largest particle.

In fine sizes of ore the gangue and galena are in separate particles; but as we pass to coarser sizes there are more and more pieces containing both minerals. This makes it unnecessary to take as great a quantity of the larger sizes as the above formula indicates. In other words, the weight is proportional to something less than the cube of the diameter. A more general form of the equation is

$$W = kD^a$$

where a may be any coefficient less than 3.

The facts that ore does not break in cubes, and that there is a large range of sizes at any stage of crushing, introduce complications in the mathematics; and it may not be quite true that the correct weight is strictly proportional to some power of the diameter of the largest particles. However, certain experimental studies confirm the practical accuracy of the above equation. For example, the necessary weights at certain sizes were experimentally determined for three ores. The constants in the equation were then determined for each of these ores by the methods to be described. From these constants calculated weights were derived for the sizes to which the ores actually had been crushed. The calculated differed from the actual weights by amounts varying from 1 to only 7 per cent.

In probability calculations, the greater the number of events or objects considered the nearer does probability approach actuality. Anyone who counts coins from a large heap, and makes a record of the number of heads and tails, soon realizes this. The most frequent result is equal heads and tails; and the greatest probable departures from this are as follows:

Number of Coins Drawn	Departure, Per Cent
10	90
100	30
1,000	9
10,000	3
100,000	0.9
1,000,000	0.3
10,000,000	0.09
100,000,000	0.03

Larger errors than the above are infrequent, but smaller departures are more common.

It will be seen that to assure precision within 0.03 per cent with coins it is necessary to draw 100,000,000. A very important fact must be observed in this connection: 1 gm. of any ordinary ore ground through a 150-mesh screen (0.004-in. opening) actually contains 200,000,000 particles or more. At this stage of grinding, no significant number of sulphide particles remain enclosed in particles of gangue, so conditions closely parallel the coin test. With copper ores this 1 gr. will yield the precision of 0.03 per cent in assaying pulp of such fineness, when using suitable chemical methods.

Because of the mixture of minerals in some pieces of coarse ore it is practically impossible to estimate the number of particles of the different minerals. There is an experimental method, however, which accurately indicates the necessary weight for any size of crushing. This method has been proved in practice, and is as follows:

In the case of average base-metal ores two tons should be taken by systematic mechanical cutting, after crushing to 2-in. size. From this material take not less than sixteen portions, of about 40 lb. each, by a series of careful riffling operations and moderate mixing at each stage. From each of these portions a pulp is prepared, through a 150-mesh screen for assay. Similar sets of samples are prepared after crushing finer than 2 in., and are carefully assayed. From the average assay of each set, and the deviations of the single results from the average, the degree of precision of each sample is easily calculated. Such small samples as 40 lb. at 2-in. size will yield results that are not satisfactory in commercial work; but by suitable adjustment the results permit determination of the weight that will yield any required precision. Having thus determined the correct weight for each of the sizes at which tests were made, the proper values of k and a in the general sampling equation are found by further adjustment. From these final results the correct weight for any size is calculated.

For precious-metal ores, especially if spotty, the weight of the test samples will naturally be greater than for base metals.

Variation in Nominal and Actual Size

It is important to notice, here, that the actual sizes in mills are often considerably larger than the nominal. This should not be allowed; it amounts to the same thing as reducing the quantity when the size is right. The openings in crushers and rolls is an unsafe guide. They always allow the passage of coarser ore than the nominal opening.

The above method has been used on three typical sulphide copper ores. It is significant to note that, when the derived constants were used to calculate the quantity at 0.004 in. for an assay precision of 0.03 per cent copper, the indicated weights were 1.0, 0.62 and 0.72 gm. These are, of course, just such weights as experience proves to be necessary in assaying, and justify the discussion of the weights in the last column of the table on p. 283.

One gram is sufficient to guarantee very accurate results on the base-metal ores, and on silica, lime, and similar rocks when ground to 150 mesh; and for the precious metals one assay ton (29.2 gm.) is enough. Even for gold ores containing metallics this is enough, provided the metallics from a larger quantity are separately assayed. Thus we have one size at which the weight is definitely fixed for practically all ores. This makes a short-cut possible in the above experimental determination of constants. If all the work is done with the utmost care, two sizes are enough to determine the constants; although the greater the number of sizes the more completely will errors of manipulation be eliminated. When two points are considered enough, one of these may be taken as 1 gm. (0.0022 lb.) at 0.004 in., or 29.2 gm. for precious metals. The other should be as near as possible to the coarsest stage at which the regular sampling is to be done. Tests should be made at that size, as already described.

Three sulphide copper ores gave formulæ as follows:

$W = 2100\ D^{2.46}$; for ore No. 1.
$W = 700\ D^{2.37}$; for ore No. 2.
$W = 600\ D^{2.33}$; for ore No. 3.

Ore No. 1 was in two lots, one of which assayed 7.09 per cent copper, the other 7.94 per cent copper. These assays, which are the average of 45 and 43 results on riffle samples from the original lots, are accurate to ± 0.01 per cent copper. Ore No. 2 likewise was in two lots, assaying respectively 2.83 and 2.84 per cent copper ± 0.01 per cent. Ore No. 3 was in three lots and the average of the three lots gave an assay of 2.54 per cent copper ± 0.01 per cent.

Each lot of the ores No. 1 and No. 2 was sent successively to three mills for sampling and re-sampling. The mills are represented as I, II, and III. Certain rejects were caught and assayed at each of these mills for each lot. During these runs no attempt was made to have the mills crush according to the indications of the formula.

SAMPLING DATA FROM PRACTICE

Mill	Kind of Ore	Coefficient (a)	Size of Coarsest Particle: 4 In.	1 In.	½ In.	¼ In.	0.2 mm. (80 mesh)	0.15 mm. (100 mesh)	0.1 mm. (150 mesh)
			Weight of Ore, Pounds				Weight of Ore, Grams		
	Base-metal ores								
A	Copper sulphide	1.32	17,200	2,760	440	71	2,090	1,430	840
B	Copper sulphide	2.05	184,000	10,700	620	36	240	130	57
C	Copper sulphide	2.08	11,800	660	37	2.1	13	6.9	3.0
D	Copper sulphide	2.32	59,400	2,380	95	3.8	14	7.3	2.8
E	Copper sulphide	2.52	13,200	400	12	0.37	0.91	0.44	0.16
F	Lead sulphide	2.80	107,000	2,200	45	0.94	1.3	0.57	0.18
G	Copper sulphide	3.76	28,800,000	157,000	850	4.6	0.87	0.30	0.064
	Precious-metal ores								
H	Gold spotty, wet, oxide	1.00	2,000	500	125	31	1,790	1,340	890
I	Gold spotty, quartz	1.00	60,000	15,000	3,750	940	53,600	40,200	26,800
K	Silver-lead	1.61	19,800	2,120	230	24	395	250	130
L	Gold, rich, spotty, quartz	1.71	26,400	2,470	230	22	280	170	86
M	Gold	1.78	24,800	2,100	180	15	170	100	50
N	Gold, rich, spotty, quartz	1.83	547,000	43,300	3,430	270	2,780	1,640	780
O	Gold	1.88	4,030	300	22	1.6	15	8.7	4.1
P	Gold, spotty, wet, oxide	2.02	6,910	420	26	1.6	11	6.0	2.6
R	Gold	2.18	33,700	1,640	80	3.9	19	10	4.3
S	Gold	2.22	17,400	800	37	1.7	7.8	4.1	1.7
T	Gold, pyritic	3.00	65,300	1,020	16	0.25	0.23	0.095	0.028
U	Silver, spotty, sulphide and native	3.43	27,000	230	2.0	0.017	0.0064	0.0024	0.0006
W	Gold	4.32	4,150,000	10,400	26	0.065	0.0038	0.0011	0.0002
(*b*)	28	1.29	30,600	5,120	860	140	4,500	3,100	1,840
	50	1.61	39,500	4,240	460	50	790	500	260
	26	2.05	36,700	2,140	120	7.3	47	26	11
	30	2.11	61,500	3,300	180	40	54	30	13
	41	2.32	100,000	4,000	160	6.4	24	12	4.8
	4	2.62	1,070,000	28,200	750	20	39	19	6.4
	24	2.62	202,000	5,350	140	3.7	7.5	3.5	0.82
	21	2.63	109,000	2,850	74	1.9	3.8	1.8	0.61
	8	3.50	3,330,000	26,000	200	1.6	51	19	0.05

(*a*) (a) is the exponent of *D* in the equation $W = kD^a$
(*b*) The last nine examples are from Technical Paper 86, U. S. Bureau of Mines. No description of the ore is available.

Results of Sundry Tests

If the crushing in the mill is done according to the indications of the formulæ—which, as determined above, are calculated to give a precision of ± 0.03 per cent copper or better in 95 per cent of the cases—it is generally true that the precision of a three-cutter mill is ± 0.05 per cent copper, while a four-cutter mill gives a corresponding precision of ± 0.06 per cent or better in 95 per cent of the cases. The following deviations were gotten from assays on samples and cutter rejects, there being one deviation for each (results are given for Mill I, Mill II, and Mill III):

In the case of Mill I (four cutters), six assays on samples and rejects gave deviations from 0.00 to 0.34 per cent on ore No. 1. Only 75 per cent of the assays were within ± 0.06 per cent. In Mill II (three cutters), eight assays on samples and rejects of ore No. 1 gave deviations from 0.03 to 0.35 per cent. Here 25 per cent of the assays were within ± 0.05 per cent. At Mill III (four cutters), twelve assays gave deviations on ore No. 1 of 0.05 to 0.55 per cent. Only one assay came within ± 0.06 per cent.

Considering ore No. 2, eight assays for Mill I gave deviations of 0.00 to 0.46 per cent, 60 per cent giving ± 0.06 per cent precision or better. Mill II on these ores gave deviations of 0.01 to 0.18 per cent in eight cases, 60 per cent being within ± 0.05 per cent. From Mill III, twelve assays on these ores resulted in deviations of 0.01 to 0.25 per cent; and 35 per cent gave a precision of 0.06 per cent or better.

All the mills gave erratic results. However, Mill I, in general, gave the best results. Screen analyses, to determine the maximum size of particle, and weighing of mill samples, indicated that the weights taken were too small to come within the limits of the formulæ given on p. 282.

Ore No. 3 was in three lots, of 43, 52, and 65 tons respectively. These lots were sent through Mill II twice, then through Mill I twice, and finally were put through Mill II a third and a fourth time. In Mill I the size of crushing was finer, at all stages, than the formula required. In Mill II during the first two runs the crushing was too coarse, but during the third and fourth runs it was according to the indications of the formula.

The results for Mill I on ore No. 3 gave deviations of 0.01 to 0.06 per cent for twelve assays, with five assays at 0.01 per cent precision, and all results within the precision ± 0.06 per cent, a result to be expected, as this mill crushed well within the limits indicated by the formula.

In the first two runs made at Mill II, twelve assays gave deviations of 0.00 to 0.06 per cent with five assays at 0.03 per cent precision, while the third and fourth runs at this mill gave, on twelve assays, deviations of 0.00 to 0.05 per cent with five assays at 0.01 per cent precision. This improvement was to be expected, because these latter runs were based on the indications of the formula.

Proposed Sampling Standards for Base-Metal Ores and Precious-Metal Ores

Accepting 1 gm. of base-metal ore as an established standard when ground to 0.004 in. maximum size, the weight for any other size may be calculated when we decide on the value of a in the equation $W = kD^a$. Similar calculations based on one assay ton (29.2 gm.), serve for precious-metal ores. The following figures, based on these two weights of 150-mesh ore, indicate the quantities required at the one-inch stage of crushing, for various values of a, together with the number of

full size average lumps that would make these weights, assuming a specific gravity of 3.25:

Coefficient a	Base-Metal Ores (1 gm. at 0.1 mm.) Weight of Ore at 1 In., Pounds	Number of Full-Size 1-In. Lumps	Precious-Metal Ores (29.2 gm. at 0.1 mm.) Weight of Ore at 1 In., Pounds	Number of Full-Size 1-In. Lumps
0.5	0.035	0.37	0.103	11
1.0	0.56	6	16.4	174
1.2	1.69	18	49.5	530
1.4	5.13	55	150	1,600
1.6	15.5	165	453	4,800
1.8	47	500	1,370	14,500
2.0	142	1,510	4,150	44,200
2.2	430.0	4,600	12,600	134,000
2.4	1,300	.....	38,000	.....
2.6	3,940	.....	115,000	.....
2.8	11,900	.....	348,000	.....
3.0	36,100	.....	1,050,000	.....

It is not likely that anyone would think it safe, with even the most uniform ores, to take as little as 5 lb. for base metals, or 150 lb. for the precious metals, when crushing to 1-in. maximum size; which means a weight equal to only 55 full-size 1-in. lumps in the first instance, or 1,600 such lumps in the second case. It is clear, then, that we should never use a value of a as low as 1.4; and it has already been shown that a should never be as great as 3.0. It is highly important, however, to make the right selection from the values of a that lie between these limits. Starting from the fixed points for 150-mesh ore, a low value of a gives a slow increase of weight as we proceed to coarser sizes; while high values give a rapid increase, and therefore conduce to more accurate sampling in the coarse stages. However, it is not always safe to make a large: practice cannot always be fixed on the basis of 1 gm. or 29.2 gm. at 0.1 mm. Suppose, for instance, that a 50-ton lot of gold ore has been crushed to 1 in. before reaching the sampling mill of a smelter; that experience has shown that 500 lb. is the proper weight for an accurate sample; and that the metallurgical treatment requires that as little as possible be crushed finer than 1 in. The high value of 2.5 for a would then indicate less than 0.01 assay ton for the gold assay of 150-mesh pulp. To arrive at one assay ton of this pulp the value of a is found to be 1.62. It is just as important to remember that high values of a indicate a rapid decrease of weight with decreasing size as it is to know that such values mean a rapid increase with increasing size.

After carefully considering present general practice, together with the investigations given in the paper, the following table has been prepared, representing what is believed will adequately cover the limits of good standard practice.

PROPOSED SAMPLING STANDARDS.

	Coefficient (a)	Maximum Size of Particle, Inches: 4	1	½	¼	Maximum Size of Particle, Millimeters: 0.20 (80-mesh)	0.15 (100-mesh)	0.10 (150-mesh)
		Weight of Ore, Pounds				Weight of Ore, Grams		
Base-Metal Ores	1.5	71	8.92	1.1	0.14	2.8	1.8	1.0
	1.7	285	27.0	2.6	0.24	3.2	2.0	1.0
	1.9	1,140	81.7	5.9	0.42	3.7	2.2	1.0
	2.1	4,550	247	14	0.73	4.3	2.3	1.0
	2.3	18,200	749	31	1.3	4.9	2.5	1.0
	2.5	72,500	2,270	71	2.2	5.7	2.8	1.0
	2.7	290,000	6,860	160	3.8	6.5	3.0	1.0
Precious-Metal Ores	1.5	2,080	260	33	4.1	83	54	29.2
	1.7	8,330	788	75	7.1	95	58	29.2
	1.9	33,200	2,390	170	12	110	63	29.2
	2.1	133,000	7,220	390	21	120	68	29.2
	2.3	530,000	21,800	900	37	140	74	29.2
	2.5	2,120,000	66,100	2,100	65	160	80	29.2
	2.7	8,460,000	200,000	4,700	110	190	87	29.2

(a) "a" is the exponent of D in the equation $W = kD^a$.

The weights corresponding to the lower values of a are suitable for very uniform ores; while those related to high values apply to very spotty ores. Those derived when a is 1.5 are perhaps too small ever to be safe; and those proceeding when a is 2.7 will seldom if ever be needed except where trouble would arise on account of metallics, as with a gold ore containing nuggets. In such a case 100 tons should be taken after crushing to 1 in.; and when this quantity had been reduced to ¼ in. it should be screened to remove all the large nuggets before cutting down to about 2½ tons. After finer crushing, this should be passed through a suitable screen to remove smaller nuggets; and this process should be continued as far as necessary.

Different Ores Require Different Handling to Secure Accurate Sampling

To insure dependable and accurate sampling of any class of ores, a reasonable amount of experimenting must first be done, by such methods as have been outlined, in order to derive the constants for the sampling equation. To guarantee that the sampling machines shall actually take the quantities intended, and make their cuts at uniform intervals throughout the lot, mixing and retarding apparatus must be installed, which will deliver a continuous stream of feed to each cutter. This need not be used ahead of the first cutter if the original total ore is fed steadily.

Much accurate sampling is being done at the present time, but there is also much room for improvement in some places. Much can be done to establish the art on a satisfactory basis, if a number of companies dealing with iron, copper, lead, zinc, gold and silver ores will unite in investigating various types of each kind of ore.

For the unusual opportunities of investigation at Butte, Mont., which the writers have enjoyed they are under special obligation to Frederick Laist, general manager of reduction works of the Anaconda Copper Mining Co.; Oscar Rohn, general manager of the East Butte Copper Mining Co., and to L. R. Margetts, superintendent of the Anaconda Copper Mining Co.'s Washoe sampler.

Engineers as Pioneers of Trade

By Kirby Thomas

The American abroad, especially in the partly developed countries in all parts of the world, is essentially a developer and a creator, and it is in this relation that he is particularly effective and successful. Already Americans have successfully built railroads, installed water-power projects, public utilities, irrigation undertakings and equipped and operated mining and oil properties in all of the Latin American countries. American capital investing in these enterprises usually requires that the business and technical managements shall be in the hands of Americans.

These undertakings, directly or indirectly, affect trade. The American engineer and manager specifies American materials for construction and American tools. He and his associates and assistants demand a certain amount of American goods for the business and for personal consumption. The local merchants are influenced to introduce American goods. The result is the establishment of a growing trade and one which is not easily displaced by competition from other countries. These items, in the aggregate, are considerable, this fact having been exemplified in the development of trade in Mexico prior to the last, and recent, era of Mexican revolutions.

CONSULTATION

Minerals Suitable for Detectors in Radio Instruments

"Will you kindly tell me what minerals have been found adapted to the work of a detector in wireless telephony? I understand that galena and pyrites are the most popular, but would like to know whether any experiments have been performed with other minerals in an effort to determine their fitness for radio work."

We do not know of any publication or article giving a comprehensive discussion of the effect of using various minerals for radio purposes. Experimental work has been performed, but we have no record of the results of the individual experimenters. The Signal Corps of the U. S. Army informs us that a large number of different minerals have been tested by various experimenters in connection with detectors for radio signals, but it is not known whether any extensive list of tests on such crystals is available or not.

According to information received from the Signal Corps, the crystal detectors in use by the Signal Corps consist mainly of galena crystals in contact with a fine point, usually obtained by a fine copper wire, the end of which makes a light contact with the crystal. This type of detector is very sensitive, but on the other hand often requires frequent adjustment to keep the crystal in the most sensitive condition. The sensitiveness of galena crystals varies widely, depending upon the mines from which the galena is obtained. A list of other crystals which have been used to a considerable extent as radio detectors follows:

1. Galena crystal in contact with point of fine copper or brass wire.
2. Carborundum in contact with fine steel or copper point.
3. Lenzite in contact with fine steel or copper point.
4. Zincite in contact with chalcopyrite or bornite or copper pyrites.
5. Iron pyrites in contact with gold point.
6. Molybdenite in contact with brass or silver.
7. Silicon in contact with gold or brass.
8. Cerussite (trade designation) in contact with copper or brass point.

With practically all of the metals listed above, the metal point in contact with the crystal can be iron, steel, copper, brass, silver or gold. The metals listed are those that have been recommended by various investigators.

The Value of Rhodium

"What is rhodium ore worth per ounce or pound? What is it used for, what amounts can be marketed, if any and where? The *Engineering and Mining Journal* used to quote it several years ago. If there is no market for it in the United States, can it be sold in France or Germany? I know of some Germans who gave $100 per ton for some ore from here (Mexico) years ago that contained rhodium. They must have made some use of it."

The *Engineering and Mining Journal-Press* regularly quotes the price of rhodium. Its latest market report gives that metal a value of $100 to $115 an ounce. However, this is purely a nominal quotation, as transactions are very infrequent, and were one to press the metal for sale a lower price might be realized. Rhodium has very few commercial uses and is principally alloyed with platinum. We understand that an alloy containing 10 per cent rhodium is used in the manufacture of thermocouples for pryometers and in the manufacture of some laboratory utensils.

Rhodium belongs to the platinum family of metals and is white in color, resembling aluminum, although it is ordinarily found in association with platinum. It is also contained in small quantities in the sperrylite found in the copper ores of Sudbury, Canada. If you wish to sell your rhodium, we suggest that you communicate with the list of dealers in platinum being sent you.

Smelter Site Silver Under the Pittman Act

"The question of the application of the Pittman Act to silver procured from a smelter site has been raised with reference to the price of such silver.

"Will you please advise whether silver so procured would be domestic silver as defined by the Pittman Act?"

We can only give our own opinion regarding the Pittman Act and the status of silver procured from a smelter site. Its administration is, of course, dependent upon the regulations of the Treasury Department.

The Pittman Act states in Sec. 2: "That upon every such sale of bullion from time to time the Secretary of the Treasury shall immediately direct the Director of the Mint to purchase in the United States, of the product of mines situated in the United States and of reduction works so located, an amount of silver equal to three hundred and seventy-one and twenty-five hundredths grains of pure silver in respect of every standard silver dollar so melted or broken up and sold as bullion." The act thus requires that silver eligible for purchase by the United States Government must be produced from a mine in the United States and must have been smelted and refined in the United States. It will be noticed that no specification is made requiring the silver to have been mined prior to, during, or after the operation of the Pittman Act.

In your case it would appear that silver recovered from a smelter site comes under the re-purchase provision of the Pittman Act, provided that you can advance sufficient evidence to indicate that the silver could by no chance be of foreign origin. If the smelter treated Mexican, Canadian or other ores at some time during its operation, this would probably be difficult to show. If, on the other hand, its ore and concentrate supply was always entirely derived from United States mines this would seem to carry the point.

It would be well to advise the Director of the Mint, Washington, D. C., of full particulars and request a ruling in the case.

USEFUL OPERATING IDEAS

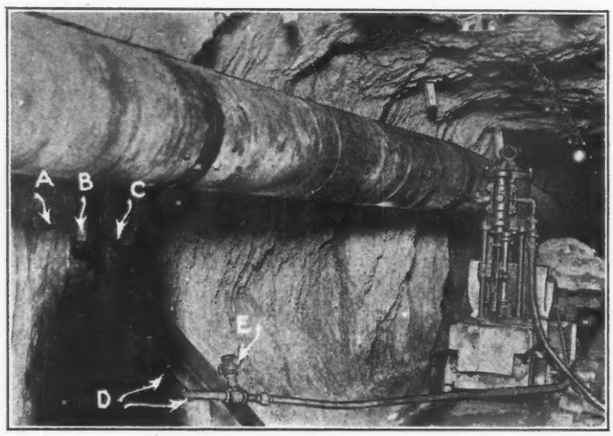
Grouting Water-Channels Underground

Fissures Cut by Star Adit Sealed After Being Intersected — Pumping Time Lessened One-Third—Special Equipment Used

BY T. A. RICKARD

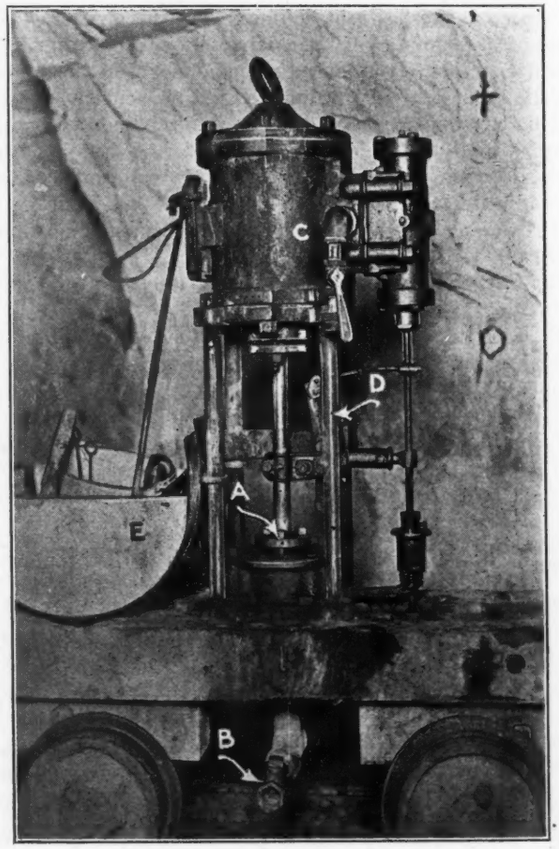
AN INTERESTING use of cement for excluding water from mine-workings is being made in the Star cross-cut, at Burke, in the Coeur d'Alene region of Idaho. The ownership of the Star was the subject of a recent lawsuit, which ended favorably to the present joint proprietors, the Hecla and Bunker Hill & Sullivan companies. On the 2000-ft. level of the Hecla a cross-cut is being driven into the Star ground. This cross-cut shows quartzite, the partings in which are at right angles to the line of the cross-cut, and parallel with these partings are several fissures that act as channels for underground water. The rock in the face of the cross-cut is comparatively dry, and so are other parts, except where these fissures are tapped. According to orthodox practice the fissures, if their position were known, ought to have been sealed in advance of the adit, by drilling holes ahead of the face and forcing liquid cement, or grout, into the water-bearing fissures. To exclude the water when once such fissures have been traversed is usually considered impracticable. However, the staff of the Hecla Mining Co., under the leadership of James F. McCarthy, the manager, has accomplished the feat; it is described in a letter I have been permitted to see, from Charles H. Foreman, the company's engineer. The method was based upon the use of cement, with sand, for similar purposes in the Hetch Hetchy tunnel, in California. The first suggestion of adopting the scheme came from Fred Searls, Jr., of San Francisco. The pump by which this 'grout' was forced into the fissures was made at the Hecla mine, by J. B. Sloan, master mechanic. On Oct. 26, 1921, the cross-cut intersected fractures from which water issued freely, the flow from the 2000-ft. level being 259 gal. per minute. The flow diminished to 148 gal. pumped on the 2000-ft. level, or a weir-reading of 45 gal. per minute, by the middle of November. On Dec. 29 a fissure 10 in. wide was cut, in 16 ft. of fractured rock, and the flow of water from the cross-cut into the level increased to 252 gal. The pumping of cement was started on Jan. 29, 1922. By mid-January the flow of water had abated to an average of 189 gal. per minute. By March 25 the weir on the 2000-ft. level gave an average reading of 97 gal.; and it must be noted that menwhile the cross-cut had been advancing and had cut into more wet ground.

The most difficult job was to check the flow of water from the fissure cut on Dec. 29; this showed an opening 10 in. wide and 32 in. long, into which one could see for 30 ft. A bulkhead of 10 by 10-in. blocks was placed as far as possible in the cavity—about 4 ft. In this bulkhead a hole was left for a 2-in. and a 1¼-in. pipe.



Equipment used for pumping grout into fissure

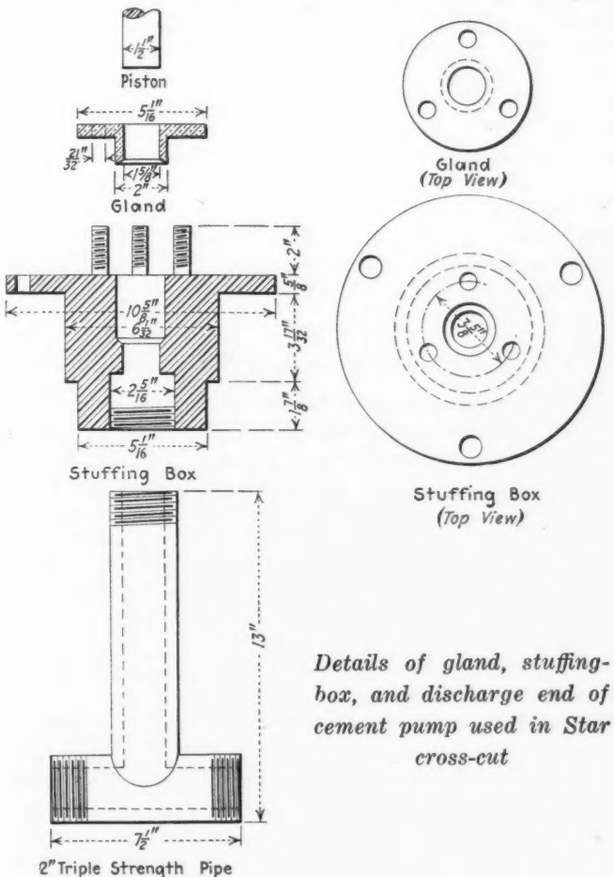
A. Pipe in hole. B Wooden clamp. C. 1-in. stop cock. D. 45° ells. E. 1¼-in. stop cock.



Cement pump used in Star crosscut

A. Gland and stuffing box made at Hecla shops. B. 1¼-in. swing check valve. C. No. 7 Knowles air-end. D No. 7 Knowles body-piece. E. Container for cement mixture

On top of the bulkhead were placed seventy-five grain-sacks and fifty cement-sacks, for packing. At the lowest point in the watercourse another bulkhead of 10 by 12-in. timbers was built, leaving room, as before, for the two pipes. The 2-in. pipe extended into the hole for a distance of 22 ft.; the 1¼-in. pipe, for 16 ft. A stopcock was placed at the lower end of each pipe, The grout was introduced through the smaller pipe, leaving the larger pipe open, so that the first foundation of grout could set before it became subject to the



Details of gland, stuffing-box, and discharge end of cement pump used in Star cross-cut

full pressure of the water in the fissure. A week later the 2-in. pipe was used for pumping the grout into the cavity. This grout was made by mixing 100 sackfuls of cement and 25 sackfuls of sand, with water sufficient to bring it to the proper consistence. It was found that the pump developed a pressure strong enough to move the bulkheads, so these were watched carefully; wherever a leak began to appear, it was checked by means of oakum and thin wedges. A machine-drill was set up and later collared at 12 to 14 ft. from the fissure, and holes were drilled toward it at an angle of 45°. These holes, distributed in fan shape, were drilled through the fissure and two feet beyond; then they were 'sprung' with one to three sticks of dynamite. Another similar series of holes was drilled from the sides of the cross-cut into the fissure, and these also were sprung. They were allowed to stand for one or two days, by which time the water had changed its flow from the fissure to the holes. If not, a new set of holes was drilled. Then a piece of 1-in. pipe, 5 to 9 ft. long, was inserted in a piece of 1¼-in. rubber hose, 3 ft. long, and put into a drill-hole. The pipe was driven into the hole until the collar of it was well packed with the rubber hose. If insufficiently packed, the oakum and thin wooden wedges were inserted around the hole. A wooden clamp 2 by 4 in. and 12 in. long, was placed around the pipe, which was braced against timbers, rails, or the back of the cross-cut.

A mixture of one-quarter of a sack of sand to one sack of cement was added to 20 gal. of water. Into the hole from which most water issued this grout was pumped, until the pipe burst or the check-valve failed. After pumping the wettest hole and using twenty to twenty-five sacks of material, it was found that water had ceased to flow from the adjacent hole. This was pumped with grout similarly. If the grout had started to run out of any other pipe, the valve was closed and it was allowed to fill.

In making the connection with the pump, two 45° elbows were placed at the pump-end near the check-valve. A 1-in. stopcock, having an iron body and a brass stem, was attached to the end of the pipe in the drill-hole. Two more 45° elbows were fixed near this stopcock, and below these elbows a 1¼-in. tee was attached, with a short nipple and a 1¼-in. stopcock. The tee was connected to an elbow near the pump by means of standard 1¼-in. pipe. This system of elbows facilitates the connection of the pump with any drill-hole, regardless of its angle. The tee with the stopcock was placed in the pipe so as to allow of starting the pump properly, before throwing pressure into the drill-hole. These details describe an important feature of the equipment.

Parts of Knowles Sinker Used in Cement Pump

Before proceeding further it will be well to describe the pump, and I shall quote Mr. Foreman almost verbatim. The pump was constructed from an old No. 7 Knowles sinking-pump, the air-end and body-piece being used. The 1½-in. piston served as a plunger, which moved through a stuffing-box packed with ¼-in. flax. Standard (1¼-in.) swing check-valves were used at the suction and discharge of the pump. The suction was connected with a round-bottomed container into which the cement mixture was poured. A screen, with ⅜-in. openings, was placed on the bottom of this container, over the point of suction, and continual agitation was found necessary to prevent the cement from settling on the screen. The air-piston was 10 in. in diameter; the plunger had a diameter of 1½ in., giving a possible pumping pressure of 3550 lb. under an 80-lb. air-pressure. At the start a wire-wound rubber hose, which had been tested to a pressure of 2000 lb., was used to connect the lower discharge of the pump with the pipe in the cavity. The pressure was too much for this hose, and it was discarded in favor of a standard 1¼-in. pipe. "It was found", says Mr. Foreman, "that when pipe or check-valve on pump failed, the hole was sufficiently pumped."

The crew for drilling consisted of three men; when the fissure was being grouted, the number was increased to six. Keen interest was shown by them in the work and that was why it was done so efficiently. The result of the operations is indicated by the decrease in pumping. Before the 2000-ft. cross-cut was started the pump on that level had to be run five hours per day; when the water-fissures were cut, they were run for twelve hours; after the grouting they had to be run for eight hours.

THE PETROLEUM INDUSTRY

Oil Prospects in Western Australia

Government Geologist Holds Petroleum Discovered in East Kimberley District Probably Derived from Rocks of Negri Series

In a report on oil prospects near the Ord-Negri River junction, in the East Kimberley district, Western Australia, D. J. Mahony, of the Victoria Geological Survey, writes:

"The bitumen is derived from the inspissation of mineral oil, and the first problem is to determine where this oil came from. There are three possible sources to consider: (1) The grits and conglomerates underlying the basalt; (2) the basalt; (3) the Negri series.

"(1) That the oil originated in the rocks underlying the basalt and found its way through the basalt to the position where the bitumen is found is most improbable, for two good reasons—namely, (a) the basalt, taken as a whole, is very compact and impervious, and these characteristics, together with its great thickness, would prevent the oil seeping through it from below; (b) both the basalt and the underlying rocks dip to the east at a fairly high angle, so that if any oil escaped from the sub-basaltic rocks its natural path would be along the junction of the two formations or through some outcropping part of the older beds.

"(2) The second alternative is obviously impossible. The basaltic rocks consist of lava and fragmental volcanic material, all of which reached the surface in an incandescent state. This high temperature would volatilize or decompose mineral oil or bitumen. Moreover, the rock contains no constituents from which oil could be subsequently formed under any conditions.

"(3) The third suggestion, that the oil came from the Negri series, is, in my opinion, correct. The bitumen is found at or close to the junction of the Negri series with the basalt, in basalt which is decomposed and porous owing to the presence of vesicles or cracks, or both. The beds of the Negri series are practically impervious. When the rocks were tilted into their present position, any oil contained in the lower part of the Negri series would find its way towards the surface along the easiest channel, that is, along the junction of the two formations and through the cracked and vesicular parts of the basalt near the junction.

"Where the bitumen is found, the geological structure favors the escape of mineral oil and there is little or no chance of finding an oil deposit in the immediate neighborhood of Oke's Find or the Negri homestead. The anticlinal fold already mentioned is, however, a most favorable structure for the concentration and preservation of underground supplies of oil. The flaggy limestones, mudstones, and shales form an ideal impervious cover for any underground reservoir, and they are free from faults or cracks that might serve as channels along which leakage would take place. They show no signs of having been affected by high temperatures or violent earth movements. Between the Ord River and the crest of the anticline or arch many excellent sections are exposed along Kelly's Creek and White Mountain Creek and their tributaries, and the strata can be seen to dip at about 4 deg. in a westerly direction with remarkable regularity. On the west side of the anticline the dip of the Negri series becomes higher and the beds disappear beneath the Mount Elder sandstones, which dip eastward at still higher angles. Near the fold, dips of 9, 10, and 11 deg. were measured in the Negri series, but further west the dip increases; the highest dip measured about 38 deg. It has already been mentioned that the axis of the anticline has a northwesterly pitch at low angle."

Much Development in Texas Field

Development continues in the Wortham-Currie field north of Mexia, Tex., where twenty-five wells are drilling and nineteen wells flowing. Recently the Humphreys-McKinney No. 1 well was completed, making 1,200 bbl. of oil. On July 12 the Texas Co. posted a price of $1.75 per barrel for this oil, or 25c. more than for Mexia crude, because of its better quality. Later, however, following the cut in Mid-continent crude prices, this price was cut to $1.50 and Mexia to $1.25. North Texas oil has also been cut to $1.75.

A number of new wells are being completed in the Pioneer field of Eastland County, ranging up to 1,000 bbl. production daily. The production of this field is expected to steady around 20,000 bbl. per day. At present the chief activity is around the Armstrong wells, in the northeast extension of the field, where several wells are being drilled.

In the so-called Laredo fields, in the southwestern part of the state, three completions were reported recently: The Kan Okla well, in the Schott field, making 650 bbl.; Aviator well, five miles south of the Schott field, 150 bbl.; and Witherspoon well, in the Mirando field, 200 bbl. Much wildcatting is being done over a large area in this part of Texas, which may result eventually in a substantial production.

In the Coastal fields, recent developments of interest were: The Hindmann-Burnett No. 1 Japhet well, at Barbers Hill, making a good flow for a short time before sanding. This should stimulate further development here. Also the No. 12 Jackson well of the Sinclair Co. on the east side of Damon Mound. Though its production is small, the well is the first producer on the east side of the mound, and indicates that a large acreage of oil-bearing ground may be developed there. The Gulf Production Co.'s No. 5 Luscher well at Blue Ridge, making 2,000 bbl. from 4,000 ft., adds new interest to this field. At Hockley, a proved salt dome for many years, and where much drilling has been done without developing oil in commercial quantity, it is reported that the Gulf Production Co. has already obtained a good showing in its No. 7 Warren well at shallow depth.

Wildcatting in Alberta and Saskatchewan Reveals Nothing but Gas to Date

C. O. Stillman, president of the Imperial Oil Co., subsidiary of the Standard Oil Co., who recently made a tour of inspection covering several districts in the West where exploration is being undertaken, has returned to Toronto. He reports that five wells are being drilled by the company in Central and Southern Alberta and two in Saskatchewan. At the last report the drill was down 2,518 ft. at Willow Creek west of Nanton, Alta., without results, but work is being continued. Near Monitor, Alta , a depth of 2,500 ft. has been reached in drilling, which is still in progress. Near Wainwright, Alta., on the Grand Trunk Pacific Railway, a drill is down 1,940 ft. at which point viscous black oil was struck, a flow of gas having previously been encountered at a depth of 1,870 ft. Drilling at Nine Head has passed the 520-ft. point and is being continued. In the Pouce Coupe district the drill encountered a flow of gas at 1,735 ft. which was cased off and drilling continued, a depth of 2,050 ft. having been reached. The well at Unity, Sask., has been abandoned after the drill had been put down 2,905 ft. Another well is being drilled in the southwestern part of Saskatchewan, the drill being down to 3,500 ft. without results. Mr. Stillman stated that while it was expected that work was in progress on the four wells in the Mackenzie River district there would be no actual news from that region until the steamers returned from their first trip north, which would probably be towards the end of July. The itinerary of Mr. Stillman's party included the Sweet Grass field in Montana, where several producing wells are in operation. The Imperial Oil Co. has not as yet undertaken any work in the Canadian territory adjacent to the Sweet Grass field.

Teapot Drilling Stopped in Orderly Fashion

The dispatch of marines to the naval oil reserve in Wyoming was accompanied by no regrettable developments. They marched to the exact spot where the drilling operations were in progress. The men employed there complied readily with the order to stop work. The marines allowed ample time to close down the work in an orderly manner. The outcome is a matter of satisfaction to Washington, as it was recognized that the attitude of the Governor of Wyoming increased the possibility of some unfortunate development. It is pointed out also that the policing of military and naval reservations by Federal forces has been continuously done since the founding of the republic. Exactly the same action was taken by Secretary Daniels, but the marines he sent out did not have exact information as to the location of a drilling operation on the Wyoming naval reserve, and, as a result, the detachment of marines wandered around for days looking for the offending operators who, in fact, never were located.

In this case, those engaged in the encroachment went onto the reserve with full knowledge of what was likely to happen. They had been fully advised before they undertook the operation that they had no title. An interesting phase of the matter is that one of those concerned declared that they would not be molested, owing to the fact that he was a personal friend of President Harding. There seems to have been no real intention on the part of the Governor of Wyoming to interfere.

Gross Production of Crude Oil Shows Increase

The American Petroleum Institute estimates that the daily average gross crude oil production in the United States for the week ended July 29 was 1,500,150 bbl., as compared with 1,498,500 bbl. for the preceding week, an increase of 1,650 bbl.

The following are estimates of daily average gross production for the weeks ended July 29, July 22, 1922, and July 30, 1921:

DAILY AVERAGE PRODUCTION
Figures in Barrels

	1922		Difference	1921
	July 29	July 22		July 30
Oklahoma	411,850	414,500	—2,650	309,600
Kansas	85,800	84,550	+1,250	95,550
North Texas	49,650	49,900	—250	70,350
Central Texas	148,700	146,900	+1,800	113,080
North Louisiana and Arkansas	125,100	126,450	—1,350	123,200
Gulf Coast	104,800	99,750	+5,050	98,220
Eastern	120,000	117,000	+3,000	121,000
Wyoming and Montana	79,250	84,450	—5,200	45,340
California	375,000	375,000	.....	336,000
Total (a)	1,500,150	1,498,500	+1,650	1,314,240

(a) Daily average production.

The estimated daily average gross production of the Mid-Continent (light oil) field, including Oklahoma, Kansas, North Texas, Central Texas, North Louisiana and Arkansas, for the same week ended July 29 was 821,100 bbl., as compared with 822,300 bbl. for the preceding week, a decrease of 1,200 bbl.

The combined daily average gross production of the Southwest field was 925,900 bbl., as compared with 922,050 bbl. for the preceding week.

Oklahoma-Kansas shows a daily average gross production of 497,650 bbl., a decrease of 1,400 bbl. North Louisiana a decrease of 900 bbl.; and Arkansas a decrease of 450 bbl. In Oklahoma production of the Osage Nation is shown as 113,800 bbl., against 115,000 bbl.; and the output of the Lyons-Quinn pool was 20,050 bbl., against 19,600 bbl. The Mexia pool in Central Texas is reported at 66,000 bbl., against 64,750 bbl.; Haynesville, North Louisiana, 54,850 bbl., against 55,700 bbl.; and El Dorado, Ark., 31,200 bbl., against 31,650 bbl. In the Gulf Coast field, West Columbia is reported at 26,200 bbl., against 25,800 bbl., and Orange County 16,800 bbl., against 16,500 bbl.

Imperial Oil Co. to Continue Work in Fort Norman Field

Members of the Imperial Oil Co.'s crews who spent the winter in the Fort Norman field have just returned to Edmonton, Alta., and report that drilling work was suspended from the end of September to the end of May, owing to insufficient fuel and the difficulty of keeping water lines thawed. Discovery well is still producing a few barrels of oil per day. It produced about 200 bbl. during the winter, but not sufficient to furnish oil for drilling at the other wells. The well at C camp, on the left bank of the Mackenzie River, opposite Discovery well, was drilled to a depth of 1,735 ft., at which point drilling was halted because the 6-in. casing proved too tight a fit for the tools. The well at Bluefish camp, on the right bank of the Mackenzie River, ten mines below Fort Norman, was tied up at 500 ft. owing to the loss of a string of tools. The well on Bear Island is about 300 ft. deep, drilling work having been delayed by trouble with casing, but operations are being continued, one crew remaining on the ground. The company is preparing to go ahead with the work.

SOCIETIES, ADDRESSES, AND REPORTS

Two- and Three-Shift Day in Industry Surveyed

Report to Be Made at Boston Meeting of Engineering Council's Executive Board Next Month

Findings in a nationwide survey of the three-shift day in American industry will be placed before the executive board of the American Engineering Council of the Federated American Engineering Societies, at a meeting of the board to be held in Boston on Sept. 8 and 9, according to an announcement following a recent meeting of the committee on procedure in New York.

Two reports, dealing with exhaustive investigations of the problems of the two-shift and the three-shift day in numerous industries, will be presented. One, prepared by Horace B. Drury, formerly of the faculty of Ohio State University, will describe the extent of two-shift operation in the continuous industries as well as the procedure followed and the results noted by those companies which have changed from the two-shift day of twelve hours each to the three-shift day of eight hours each. Mr. Drury's report will discuss the general practicability of abolishing twelve-hour turns.

Among the industries investigated are the metals, glass and cement, lime, brick, and pottery, chemicals, sugar, salt, petroleum, cottonseed and other vegetable oils, paper, flour, rubber, and miscellaneous manufactures; also mining and those industries providing electric power and light, gas, water, ice, and transportation, and others.

A second report on an investigation of the best method to be followed in changing the operations of a steel plant from two-shift to three-shift basis will be made by Bradley Stoughton, former secretary of the American Institute of Mining and Metallurgical Engineers. Both investigations are being directed by the American Engineering Council's committee on work periods in continuous operation industries, of which H. E. Howe, of Washington, president of the American Chemical Society, is chairman.

The findings of the committee, which are expected to be a notable contribution to the facts of present-day industry, will be presented to the Boston meeting of the board for definite action. A preliminary report by Mr. Drury estimates that "very roughly, the number of shift workers in the United States is probably well over 500,000, though likely not as large as 1,000,000." Industries of the South and the Far West are included in the survey as well as the industries of the East and Middle West.

The number of men on twelve-hour shifts in the industry preceding the period of depression was given as "perhaps not far from 300,000, of which about as many were outside the steel industry as within it." The committee, according to the investigators, "has been endeavoring to chart what is practically an unexplored field."

Many national economic, political, and social problems, bound up with engineering, will probably also be considered at the Boston meeting. The question of Government reorganization, involving a proposal to establish a national Department of Public Works, reforestration problems, international affiliation with engineering societies, flood control and water supply, and plans for the countrywide expansion of the Federated American Engineering Societies, will be discussed, in addition to reports of numerous committees which are considering questions of national interest.

Mortimer E. Cooley, Dean of Engineering Schools of the University of Michigan, and successor of Herbert Hoover as president of the Federation, will preside at the executive board meeting. Members of the board will be present from New York, St. Louis, Cleveland, Washington, Dallas, Philadelphia, New Haven, Buffalo, Ann Arbor, Baltimore, Topeka, Detroit, Chicago, Charlotte, N. C., and York, Pa. Universities to be represented include Yale, Harvard, Columbia, Cornell, Princeton, the University of Michigan, New York University, and Rensselaer Polytechnic Institute. The Boston meeting will include two days of business sessions and committee meetings and a social program to be carried out in connection with the organized engineers of Boston.

Announcement of the enlargement of the activities of the Federated Engineering Societies in the South also was reported. The Engineers' Club of Louisville, Ky., has applied for membership, and the committee on procedure, of which Calvert Townley, of New York, is chairman, has approved the application. The Louisville engineers probably will be formally admitted to membership at the meeting of the executive board in Boston.

Southern activity in the Federation follows President Cooley's extended trip through the principal cities of the South and Southwest.

Among the notable additions to the federation is the Engineers' Club of Columbus, Ohio, which has appointed Prof. James R. Withrow, of Ohio State University, as its representative on the American Engineering Council, the executive organ of the Federation. Professor Withrow will serve until Jan. 1, 1924.

The committee on procedure adopted and sent to President Harding a resolution expressing the hope that no action will be taken by the Federal Government regarding the recovery of patents from the Chemical Foundation until representatives of chemists, chemical engineers, chemical manufacturers, the medical profession and others most directly concerned are heard.

The resolution "implores that nothing be done which can, in any way or to the slightest extent, tend toward the ultimate return to former owners, of patents or other property, lawfully sequestered and sold to Americans."

The committee on procedure authorized the executive secretary of the Federation to begin the printing of a monthly bulletin on Sept. 1.

Producers Only Fool Themselves by Secrecy, Says Smith

Methods, Though Supposedly Concealed, Usually Known to Competitors, According to Survey Director

"Experience in dealing with producers of different commodities has shown that secrecy is largely a method by which producers have been fooling themselves," says George Otis Smith, the director of the U. S. Geological Survey, who has had long contact with production statistics. "Those who really wish to know the scope of competitors' activities have plenty of ways to find out. Secretive operators, who eventually decided to change their methods, have been surprised very much on disclosing their secrets to find that these secrets already were well known to their competitors."

This comment was occasioned by correspondence with S. K. Colby, the president of the American Magnesium Corporation. There was some hesitancy as to whether the Survey's annual chapter on magnesium should be written, as there is only one company active in its production. Presumably the company is entitled to keep its results to itself. An effort was made, however, to secure permission to use these figures so that the Survey's records would be continuous. In his reply furnishing the figures, Mr. Colby expressed his hope that the chapter would be printed, so as to record the progress in the industry. He stated that his company had nothing to lose by having its production made public.

Geologists Should Aid in Saving Resources, Says Hoover

Secretary of Commerce Expresses Regret at Inability to Attend International Congress at Brussels

Since science and engineering furnish the key to the material wealth of Nature, scientists and engineers should point the way in husbanding these essential resources, says Secretary Hoover in a message to the International Geological Congress. Mr. Hoover was appointed an honorary member of the American delegation to the Congress. He has addressed the following letter to Jean Lebacqz, the Direcfor General of Mines for Belgium and the president of the International Geological Congress:

"Duties enforced upon me by the national exigency make it impossible for me to leave Washington at this time. In expressing my regrets at being unable to participate in the thirteenth session of the International Geological Congress as a member of the American delegation, may I add my congratulations to the committee of organization on the program and excursions arranged for your guests and my best wishes to all the delegates present for a highly successful session?

"It is most appropriate that Brussels should be the host city to this gathering of eminent geologists from other nations and that your brave city has not waited in vain for this deferred honor. In the long years since Belgium's invitation was first accepted by the International Geological Congress, the world has learned to put a larger value on the man of science and especially upon the engineer. These men of peace did their part in time of war, and now their efforts for the public good are no less essential in the great task of rebuilding our sadly shaken world.

"To the geologist has come a larger share in the world's work. Humanity's heritage of material wealth is largely stored within the vaults of Nature's making, and our science and our engineering furnish the key to those vaults. Yet even more important is the fact that our geologists and engineers serve their day and generation, and the future as well, by sharing their vision of the great necessity for husbanding these essential resources, of which only one crop can be harvested. You men of science should be not only discoverers of the earth's truth, but leaders of the world's thought.

"In sending my greetings to geologists and engineers, assembled as guests of the Belgians, I crave for your organization an even larger share in the service of the nations represented."

Students Visiting Mines During Summer

Recently thirty-eight students of Lehigh University, on a visit to the mining regions in various states and in Canada, spent several days in the Michigan copper district, visiting mines, mills and smelters. Their itinerary calls for visits to copper, iron, lead, zinc, silver, gold and salt mines in the northwest states and in Ontario. The party is traveling in touring cars.

MEN YOU SHOULD KNOW ABOUT

Harry J. Evans is at Cortez, Nev.

Edward E. Pearce is at Candle Creek, Alaska.

E. M. Hamilton is at Villa Escobedo, near Parral, Chihuahua, Mexico.

J. W. Sherwin, general manager of the West End Consolidated Mining Co., has been in Tonopah from Oakland and Las Vegas.

C. N. Scott, vice-president and general manager of the Texas Company, resigned on July 1. His place has been taken by **D. J. Moran.**

W. T. Thom, Jr., has been temporarily transferred from the oil and gas section of the U. S. Geological Survey to coal statistical work.

Dr. R. R. Sayers, chief surgeon of the Bureau of Mines, recently paid a visit of inspection to the Bureau of Mines headquarters at Houghton, Mich.

M. R. Campbell has returned from an extended field trip and has entered upon his duties as acting administrative geologist of the U. S. Geological Survey.

T. A. Link, geologist of the Imperial Oil Co., is on the Hay River south of where it empties into Great Slave Lake, looking over possible drilling sites in that neighborhood.

James F. McCarthy, of Wallace, Idaho, manager of the Hecla Mining Co., is taking a brief vacation in the Yellowstone National Park.

John D. Ryan, chairman of the board of the Anaconda Copper Mining Co., has recently been a visitor at Houghton, Mich., in the Lake Superior district.

S. R. Elliott, of Ishpeming, Mich., general superintendent of the Cleveland-Cliffs Iron Co., made a tour of inspection of the company's properties on the Minnesota iron ranges recently.

B. B. Smith, former assistant geologist for the United Verde Copper Co., has received the appointment as receiver of the United States Land Office, at Los Angeles, Cal.

George J. Young, western editor of the *Journal-Press,* returned to San Francisco early in August after an extensive trip through the mining districts of Washington, British Columbia, and Alaska.

Michael Curley, superintendent of the New Cornelia Copper Co., at Ajo, Ariz., has had a copper plaque, 4 ft. high, cast in the precipitating vats and has presented it to the Boy Scouts' organization at Tucson to mark a scout camp in the Santa Catalina mountains.

Carl O. Lindberg, of Los Angeles, spent the last two weeks of July in the Coeur d'Alene district inspecting the operations of the Coeur d'Alene Syndicate, in which he is interested together with Seeley W. Mudd and Phillip Wiseman, also of Los Angeles. Mr. Lindberg also visited most of the producing mines of the district.

W. H. Carrick, who has been engineer of Car No. 9, U. S. Bureau of Mines, in the Utah-Montana-Idaho district, has succeeded **R. V. Ageton** in charge of Car No. 10 in the Michigan-Wisconsin-Minnesota district. Mr. Ageton has been transferred to the War Minerals Relief Commission at Washington, D. C. **A. J. Martinson,** car foreman on Car No. 10, has been transferred to Car No. 1 at Reno, Nev.

SOCIETY MEETINGS ANNOUNCED

The Lake Superior Mining Institute will hold its annual meeting in the Michigan copper country Aug. 28-30. Headquarters will be at Houghton. Three busy days have been planned. Visits will be made to the mines, mills and smelters. There also will be an inspection of No. 2 Quincy hoist, the largest drum hoist in the world, and the Calumet & Hecla reclamation plant at Lake Linden. A business session at the Michigan College of Mines, a dinner at the Douglass House, Houghton, a luncheon at Eagle Harbor, Keweenaw County, visits underground, and side trips to points of interest are also features of the program.

The fall meeting of the **American Chemical Society** will be held with the Pittsburgh Section on Sept. 4 to 9. The National Exposition of Chemical Industries meets in New York, Sept. 11 to 16, and members can readily go from Pittsburgh to New York for this meeting.

Association of Iron and Steel Electrical Engineers will hold its annual convention Sept. 11 to 15, at Cleveland Public Hall, Cleveland, Ohio. At this time there will be presented and discussed subjects dealing particularly with steel mill problems. Among the papers to be presented is one entitled "Electrification of the International Nickel Co.'s Works for Monel Metal."

OBITUARY

Frank W. Frueauff, junior member of the firm of Henry L. Doherty & Co., and vice-president of the Cities Service Co., dropped dead of acute indigestion in New York on July 31.

John Dodds Sharpe, for several years general manager of the Asbestos Corporation of Canada, died at Thetford Mines, Quebec, on July 25. He was fifty-five years old.

Rukard Hurd died on July 27, at Frontinac, Minn., following an operation. Mr. Hurd was director of the department of mines of the Minnesota Tax Commission and was the author of a reference book on iron ore costs and values.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

SHIPMENTS OF IRON ore from Lake Superior ports are double those of a year ago. This indicates improvement in general industrial conditions.

The Chief Consolidated company has restored its former dividend rate at Eureka, Utah.

Rich gold ore is found north of Luning, Nev.

The Mesabi Iron Co., headed by Hayden Stone and Jackling interests, offers public participation at $12 per share.

The Old Dominion mine, in Washington, has shipped a carload of $900 silver-lead ore to the Bunker Hill smelter.

R. E. Talley, general manager of the United Verde Copper Co., maintains that mining companies in Arizona are not equitably taxed.

An important discovery has been made in the East Coeur d'Alene district of western Montana.

Shipments of Lake copper are large, but the coal receipts are so meager as to cause deep concern for the coming winter.

Development north of Joplin, Mo., gives promise of a new lead mining field of importance.

Deposits of china clay and gypsum are being opened near Caliente, Nev.

Rich ore is reported in Lincoln Consolidated mine at Alma, Col.

Smelting Ore Returns Nine Hundred Dollars Per Ton

High-Grade Shipped to Bunker Hill Smelter From Old Dominion Mine Assays 878 Oz. Silver

Rivaling the famous Cobalt district of Ontario in the silver content of its ore, the Dominion Lead Silver Mining Co., operating the Old Dominion mine, seven miles north of Colville, Stevens County, Wash., has just received returns on another shipment of ore to the Bunker Hill smelter at Bradley, Idaho.

The first-class ore, consisting of seventeen tons, yielded net per ton 878 oz. silver, $3.60 gold, 19.3 per cent lead, 24.2 per cent zinc, and 3.3 per cent copper. Second-class ore, 21½ tons, gave returns 170.7 oz. silver, $1.40 gold, 6.7 per cent lead, and 13.9 per cent zinc. The carload netted the company $17,308.16. The mine is under the management of W. H. Linney.

The Old Dominion was a prominent producer of high-grade silver ore in the early 90's, but had been idle until recently.

The new orebody varies from 6 in. to 2½ ft. in width and is in limestone formation. The geological structure of the mine is complicated, consisting of a north-and-south contact between limestone and granite. The limestone in which the ore exists had been subjected to powerful post-mineral faulting and intrusion by numerous aplite dikes and sills. The ore is usually found at considerable distance from the granite contact.

In addition to the current mining, the company is now diamond drilling to trace the extention of the present ore.

Chief Consolidated, in Utah, Restores Former Dividend Rate

The Chief Consolidated Mining Co., whose mines are at Eureka, Utah, on Aug. 1 paid a dividend amounting to $88,403, as compared with $44,201 the quarter preceding, thus returning to its former dividend rate of 10c. per share, reduced to 5c. eighteen months ago, when general mining conditions were less favorable. The mine is in excellent condition, and the recent reduction in freight rates from the Tintic district will make it possible to market some of the lower-grade ores. The Chief Consolidated has up to date paid $2,255,129 in dividends.

Wages Are Advanced by Shasta Zinc & Copper Co. in California

The Shasta Zinc & Copper Co., operating at Bully Hill, or Winthrop., Cal., has raised wages for all employees 25c. per day. Miners now receive $4.25, muckers and smelter laborers $3.75, and common laborers $3.50. Two hundred men benefit by the advance.

Another Gold Reef in Transvaal, Says Report

By Cable from Reuters to "Engineering and Mining Journal-Press."

Johannesburg, Aug. 2.—Reports have been received here of the discovery of a new gold reef beginning on the borders of Bechuanaland and extending to the Rustenburg district. This follows several similar reports of discoveries in other localities in South Africa during the past month.

Mesabi Iron Co. Stock Offered at $12 Per Share

Company That Is Exploiting the Low-Grade Mesabi Iron Ores Invites Public Participation

Twelve dollars per share is the offering price of 50,000 shares of common stock of Mesabi Iron Co., a corporation engaged in applying methods somewhat similar to those of the companies exploiting disseminated copper ores to the development of the low-grade iron ores of the Mesabi Iron Range in Minnesota. The Midvale Steel & Ordnance Co. has made favorable reports on the use in its blast furnaces of the sinter, which is the final product made in Minnesota.

The Mesabi Iron Co. was organized Dec. 12, 1919, in Delaware, following the successful experiments in the concentration of low-grade iron ores which were started in 1915, by a group of capitalists headed by D. C. Jackling. It is capitalized at 559,600 shares of outstanding common stock of no par value. There has been paid into the treasury $4,750,000 in cash, or about $8 per share.

The board of directors consists of Charles Hayden, D. C. Jackling, John D. Ryan, Percy A. Rockefeller, W. E. Corey, Alva C. Dinkey, C. M. MacNeil, H. V. Winchell, Sherwood Aldrich, Seeley W. Mudd, W. Hinckle Smith, W. G. Swart, J. Carson Agnew, and John R. Dillon.

The company holds, under long-time operating leases and contracts, approximately 9,720 acres of ore-bearing lands and owns in fee practically 6,480 acres held for water supply and tailings disposal. Leases on the acreage in the

Mesabi district are different from customary iron ore leases in that royalty payments are based upon percentage of net profits and consequently are not payable when the company is operating at a loss.

From the low-grade ores, the company can make, after concentrating, a sinter averaging over 60 per cent iron and low in phosphorus and moisture. The average grade of Lake Superior high-grade ore contains about 51.38 per cent iron at the present time. Comparison of these iron contents shows that from a standpoint of freight rates only, Mesabi iron enjoys an advantage over the shipper of high-grade natural ore.

One unit of a plant with an estimated capacity of 400 to 500 tons a day has been completed. The company estimates that with the present price of iron it can do slightly better than break even with a production basis of 500 tons of sinter daily, not taking into consideration the sale of byproducts. With a production on a daily basis of 3,500 tons, the company estimates profits for a working year of 300 days at somewhat in excess of $2,500,000.

West Shining Tree, in Ontario, Is Awakening

Marked activity is evident in the West Shining Tree gold district. The Herrick has been optioned to Tonopah interests, and the Ribble is understood to be entering upon a comprehensive scheme of development. A gang of men has been started on the Westree, and arrangements are being made to start underground work on the Atlas. Work is also being continued on the White Rock.

A scheme is also under way to build a transmission line to West Shining Tree from the Matachewan Power Co.'s plant, which is now being erected on Indian Chutes on the Montreal River. Rapid progress is being made on the Matachewan power project, and the payroll averages $10,000 per month.

The Davidson-Young-McKay group of claims has been taken over by officials of the Matachewan Gold Mines, and a substantial cash payment has been made. Development is also being carried on by the Thesaurus Gold Mines, from whose property some rich samples have recently been obtained at a depth of 100 ft. At the present time the Matachewan and West Shining Tree districts are handicapped by poor transportation.

Active Prospecting in Quebec

James J. Godfrey, president of the Motherlode Copper Mines Co., of Alaska, who recently took an option on the Martin property in the Harricana Gold district of northern Quebec, has greatly increased his holdings by taking an option on several groups of claims totaling 1,400 acres. Twenty-five men are employed on the Martin property and the shaft will be sunk to 300 ft.

Protest of Colorado Mining Companies Sustained by I. C. C.

Abandonment of Branch Railroad by Colorado & Southern Not Justified

Upon protest of the Mary Murphy Gold Mining Co., the Flora Bell Mining Co., and others, the Interstate Commerce Commission has declined to permit the Colorado & Southern Ry. to abondon its branch line from Buena Vista to Romley, in Chaffee County, Col. The commission bases its action on the ground that the mining district in this region is dependent upon this line for shipment of its ore and concentrates and receipt of mining materials, and that abandonment of the road would probably result in abandonment of the mining district, with large losses of mining investments already made or contemplated.

Metal Tariff Schedule Fair, Says Senator Simmons, Democrat

Discussing the tariff bill in the Senate, Senator Simmons, of North Carolina, minority leader of the Finance Committee, which drafted the revised tariff bill, stated the metal schedule rates are more justified than others in the measure. "There were practically no cuts in the metal schedule," he said, in referring to action by the Senate on various sections of the bill. "There is not a schedule in this bill upon which the rates imposed are more justified than those in the metal schedule. They have not been reduced."

R. E. Talley, Manager for United Verde, Criticizes Mine Taxation in Arizona

Mines, Real Estate, and Livestock Pay Undue Share—Capital Is Frightened by High Taxes

That the producing mines of Arizona, paying on 58.63 per cent of the state's total valuation, are assessed on far too high a plane was declared by Robert E. Talley, general manager of the United Verde Copper Co., at a session in Bisbee of the Arizona Tax Conference, a body composed of the State Tax Commission, county assessors, and representatives of the principal tax-paying industries. Before the conference he demanded that all property be assessed as required in the Arizona laws, in accordance with its full cash value. At present he said that not only mines but real estate and cattle are over-assessed, and he favored a return to values, even at the cost of a higher tax rate. Next to labor, taxes form the highest item of cost in Arizona's producing mines and there was warning that "capital will not be interested in the development of new mines under existing circumstances." Heretofore the State Tax Commission has been assessing mines mainly on the basis of their production over a period of five years. Now, as the lean years are beginning to have their effect, it is proposed that a ten-year period shall be used in the calculation.

At the conference it was shown that the present year's figures record a decrease of $54,000,000 in the valuation of producing mines, an increase of $890,000 in the item of improvements at producing mines, an increase of $6,654,000 in the valuation of non-producing mines, owing to the closing of a number of properties, a decrease of $419,000 on non-producing mine improvements, due mainly to dismantling, a decrease of $6,258,000 on smelters and equipment, a decrease of $1,264,000 on concentrators, an increase of $1,694,000 on mining machinery and supplies, and a decrease of $1,156,000 on smelter supplies.

Austrian Mica Deposits, Being Opened, Will Supply Germany

According to a message from the *Berliner Tageblatt* to Reuters, extensive deposits of mica are being opened in Styria and Carinthia, in Austria. Experiments have shown that the mineral is well adapted for electro-technical purposes.

In Carinthia a company has been engaged in the extraction of mica for some time. For the exploitation of the Köflach fields a company with headquarters at Graz, the Oesterreichische Glimmerwerk, has been formed. The new company is taking over the working of a part of the Carinthian mica fields as well as the Köflach beds.

As Germany, owing to the loss of her colonies, no longer possesses any sources of her own of this mineral, there should be a good market for the Austrian production. The keen interest taken by the German electro-technical industry in Austrian mica is shown by the fact that Herr Walter Zörnig, of Eisleben, who worked for years on behalf of German companies at the East African mica mines, has been appointed mining manager of the newly formed Austrian mica company.

Important Vein Found in East Coeur d'Alenes

The finding of the vein at depth of 1,800 ft. from the surface, by the Montana-Idaho Mining Co. in its long tunnel at Adair, has given that section a new lease of life. The strike was made the last week in July, when the tunnel, at a little over 9,000 ft. from its portal, cut what is known as the Monitor vein; it proved to be fully 7 ft. wide. The ore assays 3 to 4 per cent copper, and contains some gold. Crosscutting is being continued, as there is a possibility that parallel fissures may exist. It is planned to drift east and west and raise to connect up with the old Monitor workings, 1,000 ft. above, where high-grade copper ore was mined and hauled by wagon to Saltese. This development has improved the outlook for the Richmond, St. Lawrence and other properties in the East Coeur d'Alenes.

July Iron-Ore Shipments from Duluth District Double Those a Year Ago

Lack of Fuel for Lake Boats May Necessitate Curtailment of Production on Ranges

Iron-ore shipments from the docks at the head of the Lakes to lower Lake ports during the month of July have more than doubled as compared with the same period in 1921. Shipments for the last month amounted to 7,688,580 tons, which, compared to 3,728,970 tons as of July, 1921, shows a gain of 3,959,610 tons. The total shipments to Aug. 1 amount to a grand total of 14,840,618 tons, which is a gain of 5,004,180 tons over the same period last year.

These shipments, in spite of the railroad and coal strikes, also with the knowledge that the car supply of one of the railroads supplying the mines was greatly curtailed, tends to show the upward trend in the iron and steel business. It is possible or even probable that the car situation will improve, but the coal situation on the iron ranges is a peculiar one, and on the Great Lakes it is a very serious one for the ore-carrying freighters. On the iron ranges many of the operators have their season's supply of coal in stock, while others rely upon contracts with coal companies which calls for a definite tonnage per month; but, owing to the new order of rationing coal by the United States Government, these contracts may not be fulfilled. Under the above-noted circumstances a curtailed operation or a complete close down for the last named operators, depending upon what proportion of their requirements they will be able to receive, is in prospect. The coal shortage at every port on the Great Lakes becomes a little more serious every day, and unless greatly improved in the next few weeks will cause many boats to tie up until conditions improve, which will cause curtailed operations on the ranges. The condition can only be partly remedied by a rapid settlement of both strikes.

Corrugated Zinc Makes Roof and Sides of Joplin Concentrator

Attention is being called to the Crestling, Kan., field, by recent activities there on the part of the Kanok Metals Co. The company has just completed the rebuilding of its McBee mill, which was burned last March. In rebuilding the mill corrugated sheet zinc was used exclusively for roofing and siding. It is the first mill in the field to be so constructed. As rebuilt, it will have slightly more capacity than did the one burned, or about 400 tons per shift. The ground is being drained with two balanced-head turbine pumps, one 12 in. and the other 10 in. The mill was to have been started in operation on Aug. 8. Mining is conducted at a depth of 182 ft. A. M. Gaines is manager.

Spanish Hydro-electric Plants Will Conserve Coal

The Sociedad Hidro-eléctric a Española hopes soon to put into operation its works at the Dos Aguas fall, which will relieve it of the necessity of employing coal at seasons of low water, according to a message to Reuters from Madrid. This will represent a saving of about 45,000 tons of coal per annum. Several important hydro-electric companies have works of considerable extent in progress of construction with the same object, and when all the works are completed the diminution in the use of coal now consumed in steam-electric plants may be estimated at at least 200,000 tons per annum.

Swansea Lease Finally Gets Branch Railroad

After several years of bickering and litigation, the Swansea Lease is understood to have acquired the twenty-seven-mile broad-gage railroad that connects the camp of Swansea with the Arizona & California division of the Santa Fe system at Bouse. The railroad was held by the Mitchell interests, of Los Angeles, which on several occasions have petitioned the Arizona Corporation Commission to permit the junking of the system and the sale of its poorly maintained rolling stock. Repairs have been kept up by the Lease, which has been shipping ores and concentrates to the Humboldt smelter.

News from Washington

By PAUL WOOTON
Special Correspondent

Federal Coal Distribution Is Complicated Undertaking

Tendency on Part of Producers to Accept High Price, if Offered, Will Evoke Congressional Action

For ten days the office of the Federal Coal Distributor has been busy day and night. It already has been demonstrated that H. B. Spencer and his associates have a comprehensive grasp on the situation and are entirely capable of carrying out the very remarkable plan which Secretary Hoover has worked out. The trouble is they are being called upon to make bricks without straw. Just how much of a success they will be able to make of the job, in view of the flimsy authority to which the Federal Government can lay claim, is questionable.

One thing is certain: the coal operators are on trial. They have been put on their honor, but if they yield to the temptation of accepting prices above the maximum agreed upon, it is believed that nothing then can prevent regulatory legislation. Just now Congress regards the strike as something of a hornets' nest. The administration has won no commendation for its efforts. Because of the danger of being stung, Congress will keep away from the hornets' nest until after the strike is over, but if there are developments which indicate that coal operators have taken selfish advantages, it will supply the ground desired by those legislators who are anxious to put coal on a public utility basis.

Detailed instructions have been sent to the governors of various states by the Federal Fuel Distributor so as to provide a uniform method of handling the work. Fuel Distributor Spencer has prescribed a form which is to be followed by the governors in making application for coal. The form calls for the name of the applicant; the point at which the shipment is to be delivered; the name of the delivering railroad; the purpose for which the coal is to be used; the quantity, grade, and size of coal; the consignee's average daily consumption; the consignee's present stock; the name of the firm with which the applicant has a contract; the district from which coal ordinarily is supplied, and the name of the bank which will guarantee payment when the coal is shipped.

Another form has been devised on which the district committees will report on orders placed. The governors' committees are requested to apply for coal produced in other states through the Federal Fuel Distributor only.

Mr. Spencer emphasizes in his letter to the governors that there is no anthracite available for distribution; that emergency coal may be had only for current use and not for storage; that emergency coal may be had only for the essential purposes outlined by the Interstate Commerce Commission, and that all coal will be placed f.o.b. railway cars at the mines at the fair prices for that district approved by Secretary Hoover.

Rebate Granted Grasselli Chemical Co. by I. C. C. Ruling

The Grasselli Chemical Co. is to receive a refund of some $2,000 from the railroads which levied unreasonable freight rates on shipments of iron pyrites between DeKalb and Newcastle, Pa. The Interstate Commerce Commission, in an opinion just handed down, has ruled that the freight charges were unreasonable to the extent that they exceeded $3.90 per long ton. The shipments were made when labor troubles prevented the securing of supplies of zinc ore at the company's sulphuric-acid plant. Iron pyrites were substituted and forty-three car loads were moved. A rate of $5.30 was assessed on the ground that it was a sporadic movement. The commission decided that in view of the fact that 3,163,660 lb. had been moved, the chemical company was entitled to a rate which would accord with the general ton-mile earnings.

Federal Court of Conciliation Proposed to Settle Industrial Disputes

Senator Spencer, of Missouri, has introduced a bill in the Senate to create a Federal Court of Conciliation of three judges to pass on industrial disputes. The judges would have the same qualifications and powers as district judges, and would be appointed by the President. One would be presiding judge. The bill proposes that the court shall meet at such places in the United States as it may determine and at such places as directed by the President. The bill confers jurisdiction on the court to hear and determine controversies affecting the operation of interstate commerce as may be brought before it and to enforce its decisions in the same manner as existing federal courts.

The court would adjudicate disputes between employers and employees on its own motion or on application of either party to a controversy in connection with the transportation of commodities in interstate commerce or in connection with any industry whose product is directly or immediately essential to such transportation. Jurisdiction of the court would begin, however, only after unavailing efforts of the parties to the dispute to settle it by conference, conciliation, or voluntary arbitration, and where the dispute should endanger the general welfare of the people.

When the court had heard the merits of the controversy it would issue interlocutory orders, decrees, or judgments to settle the controversy and protect the interest of the parties involved and secure the continued and efficient operation of interstate commerce. Either party to the dispute would after abiding by the court's order for thirty days have power to request the court to modify or reverse the order, which would be considered by the court. Provision is also made for appeals from the Conciliation Court to the Circuit Court of Appeals for the district in which the dispute occurs and for certification of cases to the Supreme Court by the Circuit Courts, which would be empowered to advance the cases for early determination. Pending these appeals, however, the orders of the Conciliation Court would remain in effect.

The bill stipulates that "no order, judgment or decree shall require any individual man to work except when and where and under such conditions as he pleases."

Unfair Tactics in Marketing Lead Products Charged

A complaint of unfair competition has been made by the Federal Trade Commission against the National Lead Co. It charges the company with enforcing a system of fixing and maintaining specified standard prices at which its white lead, litharge, and paint products are sold, through co-operation of wholesale and retail dealers.

Commerce Commission Makes Rulings — Rail Extension Sought to Kansas Mines

Deciding the complaint of the West Virginia Metal Products Co., the Interstate Commerce Commission holds that the rates on brass and copper sheets, rods, wire, and tubes from Fairmont, W. Va., to Cincinnati, Ohio, are unreasonable, and directs the railroads concerned on or before October 20 to establish rates which do not exceed those from Pittsburgh to Cincinnati.

In a complaint to the commission the N. and G. Taylor Co. alleges unreasonable rates on pig tin from Perth Arboy, N. J., to Cumberland, Md.

To provide an outlet for lead and zinc products the commission has been requested by the Kansas City Southern Railway for authority to extend its line from Lawton to Baxter Springs, Kan.

Unreasonable rates on bauxite ore from various points to Omaha are alleged in a complaint to the commission by the Metropolitan Utilities District of that city.

Decreased Population Does Not Spell Ruin in Alaska, Say Officials

Some citizens in Alaska are reported to be much discouraged by the decrease in its population. Officials in Washington familiar with Alaska point out that progress in such an area cannot be judged by population figures. It is their contention that no cause exists for discouragement in anticipating the future of the Territory. During the period of placer-gold stampedes, there were rapid influxes of population, but with them came so many nomads filled with wanderlust that they soon were attracted elsewhere. Alaska will have a stable and increasing population, once the development of its resources begins on a large scale. Just now, these officials say, the territory is passing through the period of discovery and of preparation. They believe this process is going forward as rapidly as can be expected in an area where the resources and economic conditions favor only a gradual but stable growth.

News by Mining Districts

QUEENSLAND

Chillagoe State Smelters May Resume —Copper Company Faces Many Problems

From Our Special Correspondent.

Brisbane, July 3—Apparently with a view to the restarting of operations at the Chillagoe State smelters, the manager is offering special concessions to miners of low-grade carbonate lead ores as an inducement to send them in for treatment. During the last year or eighteen months large quantities of these ores have been stacked at the smaller mines awaiting a better market, the miners having sent away only those rich enough to be profitable at the low prices ruling. The offer now is for the government to pay, in the case of ores containing not less than 12 per cent of lead, a flat rate of 1s. per unit, free of all treatment charges, for the full lead contents, less two units; and for the full silver contents, less 1 oz., at 1s. 6d. per oz., the only impurity to be penalized being bismuth.

Although the Mount Cuthbert Co., owning copper mines and smelters in the Cloncurry district, did neither development work nor smelting, and made three calls, during the past half year, a loss of £9,835 for that period is shown. Had the company been producing copper under existing conditions, the loss would have been much greater. Ore reserves remain as at previous reports—namely, 193,500 tons, containing 13,245 tons of copper. The company has produced since starting operations 7,879 tons of blister copper from 136,192 tons of ore. The management mentions, as conditions precedent to the resumption of productive work (given a slight further rise in the price of copper), (1) cheaper fuel when the railway to the Bowen coal field is finished, (2) a reduction in railway and oversea freights as well as in mining requisites, and (3) an adjustment in wages in proportion to the lower cost of living. The secretary of the Mount Elliott company a short time ago added to these factors increased efficiency and reliability from labor. It is presumed that the reduction in fuel refers to coke as well as coal, and at present no provision is being made for a coke-making plant at the Bowen coal field.

Other tin mines besides the Sardine, in the Kangaroo Hill field, are showing good returns. One of these is the Canary, a mine about four and one-half miles from the Sardine, operating on a lode distinct from that of the latter, although producing ore of a similar character. In different parts of the Canary, ore going from 45 to 50 per cent of tin oxide is showing. A return just reported is 4 tons 5 cwt. of black tin from 12 tons of ore. In April last, when the shaft of this mine was down 52 ft., 39 ft. of ore was showing on one side and 20 ft. on the other. At that time a crushing of 16½ tons gave a yield of over 7½ tons of tin, making a total output of 20 tons from 55 tons of ore—the result of only four months' work.

When prospecting was resumed some months ago on the old Palmer gold field, which gave such rich returns in past years, it was confidently expected that another bed of slate, and consequently a deposit of gold, would be found beneath the sandstone strata. It was estimated that this bed, in the Ida mine, would be reached at 380 ft., but a bore taken to 400 ft. did not strike it, and boring has now been started at another site.

Johannesburg Letter

Estimated Ore Reserves 316,000,000 Tons at 1921 Working Cost, or 544,000,000 at Pre-War Cost

BY JOHN WATSON

Johannesburg, July 4—At the meeting of the Chamber of Mines on June 26, Sir Evelyn Wallers referred to the present position of the gold mining industry. The principal factors in the improved economic basis are: (1) The cost of living allowance is being abolished from June 30 owing to the fall in price of most articles of food and other living expenses. The basic rates of pay are now about 10 per cent higher than in 1914 and the workers have shorter hours, extra pay for overtime, and holiday leave. (2) The contract system underground is now on the "no cost" system, which prevents the excessively high cheques formerly earned by contractors. The recently formed Rockbreakers' Association has laid before the chamber certain proposals which are now being fully considered. (3) The managements can now arrange their underground work so as to do away with the shibboleth of "one man one job." This has had the effect of dispensing with certain Europeans whose services were superfluous. (4) Control by the management has been re-established, so that the mine manager is once more master in his own home.

A statement prepared by the Chamber was sent in to the Mining Industry Board on June 26, showing that at the 1921 rate of working costs (25s. 8d. per ton), the total tonnage available in present producing gold-mining properties on the Rand is estimated at 316,000,000. At a working cost of 17s. per ton (the pre-war cost), the total tonnage available would be 544,000,000. In addition to this increase, it is estimated that over 300,000,000 tons are available, in other areas of the Rand, which would be brought within the payable limit.

The Rand Refinery is now able to deal with the whole of the precious metals produced in South Africa. It is expected that a considerable saving will be made on the refining charges as compared with the past practice of sending all gold overseas.

The local newspapers here have been discussing the reported find of a rich gold deposit in South West Africa. Two of the leading members of the syndicate are in the Criminal Investigation Department and are at present engaged by the government in connection with the Bondelzwart rising. Further figures have been published, showing that two samples assayed by the Standard Bank gave 3 oz. 2 dwt. and 12 dwt. per ton respectively. The German Government Laboratory has assayed samples showing 40, 42, 55, 67, 70 and 91 dwt. per ton. Considerable deposits of galena, near Kleinkarras, have been known of and worked in pre-war days; now, one hears of fresh finds of galena.

People at a distance regard South Africa as a warm country. Johannesburg is 5,735 ft. above sea level and on June 26 we had, at the observatory, a record frost, 22.8 deg., or 9 deg. below freezing. This has kept plumbers busy, attending to burst water pipes.

MEXICO

Sonora

Fuel-oil Engine Replaces Steam Plant at Progresso Mine

Batuco—A. MacFarlane, manager of the property of the Progresso Silver Mines Co., in the Batuco district, Sonora, has returned from New York, where he has purchased a new power plant, made necessary by the difficulty of securing fuel. He bought a 200-hp. Price internal-combustion engine, made by the Ingersoll-Rand Co. Heretofore a steam plant has been in use but coal costs proved prohibitive.

ONTARIO

Lake Shore Will Enlarge Mill—Deeper Shaft Is Also Planned

Cobalt—A brief financial statement of the Nipissing as of July 1, 1922, shows cash, bonds and investments amounting to $3,719,392, and bullion on hand, in transit, and ready for shipment to the value of $966,582, a total of $4,685,974.

The Victory Silver is crosscutting at 400 ft. to find the rich ore shoot cut in the shaft.

Directors of the Peterson Lake have refused an offer of 25c. per share for the property, half cash and half on terms; it is understood they are holding out for 35c.

Coniagas has put down four diamond-drill holes on the Holmes Township property, which it has under option, but it is understood that results have not been encouraging.

Kirkland Lake—Diamond drilling will start on the Kitchener property, which lies north of the Wright-Hargraves.

The balance sheet of the Lake Shore for the half year ending May 31 shows profits of $169,167, as compared with profits of $51,723 for the entire previous year. The property has produced to date approximately $2,000,000 and the president states that not more than 20 per cent of the ore indicated above the 600 level has been mined. The shaft will be sunk to 800 ft. The mill is to be enlarged, and air compressing equipment added.

Porcupine — McIntyre has taken over the Schumacher Veteran claim adjoining the Dome on the north. The price is $400,000. The property will be explored by diamond drills.

West Dome Consolidated is considering sinking the main shaft to 1,000 ft.

When Vipond shareholders met to ratify the agreement to option treasury stock to A. E. Moysey at 40c. per share, a surprise was sprung on the meeting when another firm offered to underwrite 334,334 shares at 50c. Following this offer the directors were advised to sell the remainder of the stock not subscribed for by shareholders, to the highest bidder.

London Letter

South Kalgurli Netted £28,472 Last Year—Minerals Separation Experiments With Coal Recovery

BY W. A. DOMAN

London, July 28—Mining in Australia is probably conducted under more onerous conditions than anywhere else in the world. In addition to the difficulties that are common to mines elsewhere, there is the great factor of labor. Where labor rules matters do not go well, and the awards that have been judicially given against the mining industry have greatly increased operating expenses. The South Kalgurli is only a small property, but obviously it could be worked to better advantage if normal conditions existed.

The directors' report for the twelve months to March 31 states that work was carried on under great difficulties, due to the excessive rate of wages. In order to carry on at all, a grade higher than the average of the mine was treated, and even then the profit was almost entirely derived from the "premium" on gold sales. From 81,368 tons of ore, 35,964 oz. of fine gold was obtained, and realized at normal price £139,939. The mining costs were £138,614, and taxation raised the outgoings to £143,338. The premium brought in £31,871, so that on balance there was a surplus of £28,472. For Australia the mine is really of low grade, as the ore reserves do not average more than 8 dwt. per ton. This, however, is better than in the previous twelve months, when the average was 7.27 dwt. per ton. The total blocked out is 176,000 tons, and probable ore of much lower grade is given as 83,000 tons. The reserves, therefore, are equal to a little over three years' supply for the mill. Development work has been on a small scale owing to heavy costs, but much of the driving was encouraging; ore averaging from 12 up to 19 dwt. over about 60 in. was disclosed.

Minerals Separation experienced misfortune last year, largely as the result of the continued depression in the base-metal industry, entailing a large decrease in the output of metal by the company's licensees and consequent loss of royalties. The company has been erecting fine-coal recovery plants, but owing to the depression in the coal trade, these plants, from which much is expected, have not got into regular working. Similar conditions seem to prevail in most countries where the Minerals Separation is operating, Australia, South America and Spain being specially mentioned in the company's report. During the current year the results should be much better, for a definite long term contract has been signed with the Powell Duffryn Steam Coal Co. Experiments on a large scale have been carried out during the last calendar year, mainly in connection with reducing the moisture contained in coal, in order to render it suitable for dry coking, and also for improving the recovery of nitrate of soda.

CALIFORNIA

Mining, Irrigation, and Power Project Started — Alleghany-Forest District Is Active—Oil-price Reduction Closes Wells

Special Correspondence.

San Francisco—Preliminary work has begun on the dam of the Yuba Development Co. at Bullard's Bar on the Yuba River. Construction of a road to the site of the dam will be the first step in an enterprise designed to facilitate the mining of numerous hydraulic properties in Yuba, Sierra, and Plumas counties. Five dams are to be erected eventually, and the combined mining, irrigation, and power projects of the company will represent a large investment. The gold properties were yielding substantial returns when "anti-hydraulic" legislation forced suspension of work. The plans have been approved by the state and Federal debris commissions.

Activity is marked in the Alleghany-Forest district of Sierra County. About 500 men are employed within a radius of a few miles of Alleghany, and housing is scarce. The Kenton mine, on Kanaka Creek, was sold recently to a San Diego syndicate, and is to be reopened on Sept. 1; it is equipped with a ten-stamp mill. The Sixteen to One company is preparing to double the capacity of its reduction plant. Work is to be resumed on the Gold King property.

Many of the oil companies operating in Kern County will be forced to shut down, as a result of the second cut in the price of petroleum at the well, announced recently by the Standard Oil Co. Under the new schedules oil of 14 to 19.9 deg. gravity will be received by the company at 60c. per barrel, the lowest quotation since before July 7, 1916, when the price was raised from 58c. to 63c. per barrel.

Dredging operations on the West Branch of the Feather River near Magalia, Butte County, have been started on what is known as the Highland Chief mine. It comprises a claim about two miles northeast of Magalia. The gravel will be screened and washed in a line of 12-in. sluices 500 ft. long, with Hungarian riffles. A 3-in. centrifugal pump driven by a gas engine is to be used to pump water from the river to the sluices.

During the three weeks ended July 26 prospectors filed for record 133 quartz locations and 44 placer claims in Plumas County. This is the largest number located during any one month for many years. The claims were chiefly in the proved gold belts of the county, although several copper claims were located.

The Engels Copper Co., in Plumas County, is employing about 550 men. The property comprises two main mines, one and one-half miles apart, which are connected by means of a rope tramway. This is to be abandoned next year, and the two camps will be consolidated when the tunnel now being driven connects the mines. About 300 ft. per month is being driven, which will complete the tunnel during June, 1923.

The iron mine of the Noble Electric Steel Co. at Heroult, Shasta County, is shipping an increasing amount of iron ore.

BRITISH COLUMBIA

New Shippers in Slocan District—Florence Discovery Proves Important

Ainsworth—At the Florence mine the raise from the No. 5 level shows a full face of high-grade mill ore, a large proportion of which can be hand sorted and shipped direct to the smelter. The operators believe they have found the downward extention of the Bonanza shoot, asserts F. R. Wolfle, general manager. The bins are full of ore from the development workings, and the mill has again started full blast. The shoot formerly produced $500,000 from the 200 level to the surface; the ore averaged 28 per cent lead and 9 oz. silver. In addition to the raise penetrating the orebody the 500 level will be extended north, picking up the shoot on this level.

Silverton—The Van Roi mine has just sent a shipment of fifty-eight tons to Trail, this being the first car this season. The Gold Hill at Taghum shipped eight tons last week. The Meteor mine has ordered a compressor, and will resume operations in a few days.

COLORADO

Idaho Springs Plans Celebration of Gold Discovery in 1859—More Rich Ore in Portland Mine

Idaho Springs—The first discovery of gold in Colorado in paying quantities, which was made in this place in 1859, will be celebrated by the mining men of the state on Sept. 2, 3, and 4. Pioneer mining men from all over the country will gather here to celebrate the discovery and the general revival of mining activity throughout the state. A typical mining camp of the early 60's will be restored and many of the old prospectors will relive their earlier days in Colorado mining camps.

Ouray—The Atlas Mining & Milling Co. is increasing the capacity of the mill and constructing additional accommodations for mine and mill force, with the purpose of increasing output to begin about Oct. 1. The Ophir Loop Mines & Metals Co. is installing a flotation unit at the mill.

Cripple Creek—The Ajax plant has been steamed up preparatory to examination of the property in connection with the proposed sale of the mine to an Eastern syndicate. The high-grade streak which was struck at the surface on the Solomon mine continues in the shaft, which has now reached 60 ft. Grab sample of the ore assayed 6½ oz. gold. A third strike of rich ore was made in the Portland on Aug. 1, the ore being found in the south drift of the 2,600 level.

ARIZONA

Copper Queen Cast 8,500,000 lb. of Blister at Douglas During July—United Verde Starts New Cottrell Plant

By J. H. McClintock

Bisbee—Copper Queen bullion production at Douglas will be at the rate of 10,000,000 lb. per month. The July output was about 8,500,000, or a million pounds more than June. In operation are two blast furnaces and two reverberatories. More than a quarter of the July copper came from Clifton concentrates, hurried to the furnaces from smoldering concentrate piles. The supply of concentrates from the Moctezuma mill has been cut off for ten days or more by washouts on the Nacozari railroad. There appears no intention of materially increasing the ore output at Bisbee, where the old bins are being cleaned and where Sacramento Hill is yielding its first copper, an exposed face being steam-shoveled to secure siliceous ore for the furnaces.

Tombstone in July shipped fifty carloads of ore, largely lead-silver, to the Douglas and El Paso smelters. About 150 men are employed, mainly on leases.

Skilled miners are reported wanted in the southern Arizona mines, though common labor is in adequate supply. Hundreds of miners are expected back as soon as winter sets in in the northern camps.

Miami—In July the International smelter cast about 17,500,000 lb. of copper bullion. This is the average for the five months the plant has been in operation. The bars are shipped about as fast as cast, usually to Galveston, and thence by boat to Atlantic ports.

Kingman—It is considered possible that the gold belt of the River Range extends directly northward from Oatman a distance of fifteen miles, to a point where the Northern Consolidated Co. is tunneling 600 ft. into a quartz vein, developed from the surface and sampling $8.40 a ton in gold and silver.

At a meeting here of stockholders of the White Hills Mining Co., Kent F. Keller, of San Diego, was elected president. Henry Schaefer, Jr., of Los Angeles, elected treasurer, is son of Henry Schaefer, who, thirty years ago, discovered the mine and who later sold it to the Moffatt interests, of Colorado.

Jerome—The first section of the Cottrell smoke-treatment plant of the United Verde smelter at Clarkdale has been started, handling the greater part of the fumes from the works, with good results.

Verde Central has started three headings from its 800 station, two of them to crosscut the vein and the third a drift to the southeast. All the faces are in soft, mineralized ground. The company has more than doubled its acreage by late purchase of the Venture Hill and Verde Apex properties, to the southward.

NEVADA

Newly Organized Company May Build Smelter at Eureka—Rich Strike North of Luning

Luning—Two prospectors recently cut a high-grade shoot of gold ore in an old partly developed mine about two miles south of the old Illinois mine, which is about forty-five miles north from Luning. The strike was made about the middle of July, and to date $20,000 worth of ore has been mined. The vein is narrow, averaging about six inches in width, but is very rich. It occurs, according to reports, at an andesite-granite contact.

Royston—The Betts lease on the ground of the Hudson Mining Co., which has produced ore of a gross value of about $37,000, has been sold to the Super Six Mining Co. At the time of the sale the oreshoot had pinched to a seam, although it was still rich, and the lease holders were apparently hesitant about doing any more work for fear of spoiling its appearance entirely. The new owners are doing active work, and chances are regarded as good.

The Hudson Mining Co.'s new shaft has reached a depth of 465 ft., with no new developments of importance reported.

Eureka—The Eureka Smelting & Mining Co. has been organized, with a capital of $10,000,000, principal office to be in Eureka. It is understood that this company will take over the Eureka Palisade R.R., and build a smelter. The ores of Eureka district contain lead, silver, and gold, and while some of the ores are amenable to cyanide treatment, others are not. All the ores can be successfully smelted, and the proposed smelter will take custom ore, thereby giving any operating company an opportunity to get its ore treated at a reasonable cost.

The Eureka Croesus has 1,000 tons of $100 ore ready to ship. This ore was mined from winze workings 400 ft. below the 400 level from the Catlin shaft, and is said to run higher in gold than is usual for the district.

Caliente—The sale of two claims covering a deposit of gypsun near Vigo, forty miles south of here, is reported by John B. Bradshaw, the purchaser being F. L. Parriot, an oil man of Pomona, Cal., who expects to erect a plant at Vigo, which is situated about one-half mile from the deposit. Associated with Bradshaw as part owners in the gypsum property are Moody and Matt Reece, A. D. Martin, Walt Huston, and A. L. Scott. Engineers who have recently examined the deposit say that there are 4,000,000 tons of high-grade gypsum exposed.

The last payment on the properties controlled by the American Clay Co. has been made by I. R. Landis, president. J. Boggs, consulting engineer, has just completed an examination of the deposit and his report states that the clay now developed and available for extraction will compare favorably with the highest grade European China clays.

NEW MEXICO

Regular Production of Gold and Silver

Mogollon—The Mogollon Mines Co. is operating steadily, employing from 130 to 150 men. The output for the first six months of 1922 amounted to 24,439 dry tons, with a production of 3,188 oz. gold and 157,477 oz. silver, having a total value of $221,141. Its forty-stamp mill and cyanide plant have been operating to capacity. An important new orebody is being developed in its Confidence workings, which has promise of being the largest opened up in a number of years. S. J. Kidder is general manager.

IDAHO

Orofino—The Bailey dredge, which has been working for a number of years on Orofino Creek, is being reconstructed on Rhodes Creek, and is expected to be in operation in its new location about Sept. 1. The Bole Mining Co., in which Seattle and Spokane capital is interested, has started operations on a group of thirty gold claims acquired near Rhodes Creek.

Hailey—The payroll of the Mascot mine now numbers forty-two men. Foundations for a power house and a new boarding house have been completed, and a sawmill has been built.

WASHINGTON

Good Ore in Mine Recently Taken Over by Boston-New York Mines Co.—Activity Near Colville

Republic—A recent strike of silver-lead-copper ore is reported by A. M. Nash, manager of the Boston-New York Mines Co., on its property two miles north of Curlew. This property, formerly known as the National Silver Lead Mining Co., has been taken over by the Boston-New York Mines Co., a local organization with headquarters at Spokane. The strike was made on the surface of the Top Hand claim while performing the annual assessment work. A vein 6 ft. wide averaging $40 in silver, lead, and copper has been traced by means of open cuts about 300 ft. The new find will be developed by extending the lower crosscut tunnel 600 ft. to a point 700 ft. vertically below the outcrop. The lower crosscut is now 1,090 ft. from the portal and has cut one vein 4 ft. wide carrying $20 per ton on which drifts have been extended 100 ft. The compressor plant has been overhauled.

Colville—Rumored reclassification of land formerly designated as mineral lands on the south half of the Colville Indian Reserve has resulted in renewed activity among the prospectors of the district. Mike O'Connell has recently surveyed for patent the Colorado group, consisting of ten claims. The Longstreet interests will add several claims to its group by applying for patent soon. The Addison Copper Co., at the head of Nine Mile Creek, recently completed surveys on its group of eight claims, and is now mining high-grade copper-silver ore for a trial shipment.

UTAH

Four Mines Are Shipping From Alta—New Orebody in Victoria Mine at Eureka

Salt Lake City—A cloudburst at Magna did considerable damage to property in the town itself, and some injury to Utah Copper's Magna plant.

Alta—There are four mines shipping from this camp, and a good tonnage is looked for during the present shipping season. Shippers are the South Hecla, Michigan-Utah, Wasatch Mines, and the Columbus-Rexall. The Michigan-Utah is sending ore over its reconstructed aërial tramway. This material is coming from a stope on the Harrison fissure opened in the Emma limestone at a depth of 852 ft.

Park City—Shipments for the week ended July 29 amounted to 3,992 tons. Shippers were: Ontario, 1,415 tons; Silver King Coalition, 856 tons; Judge, Daly, and Daly West, 814; Park-Utah, 817 tons.

Eureka—Tintic shipments for the week ended July 29 amounted to 137 cars, as compared with 149 cars the week preceding. Shippers were: Chief Consolidated, 54 cars; Tintic Standard, 30; Grand Central, 14; Victoria, 11; Eagle & Blue Bell, 10; Iron Blossom, 9; Tintic Drain Tunnel, 3; Swansea, 2; Colorado, 1; Sioux Consolidated, 1; Centennial-Eureka, 1; Gemini, 1. The Victoria has opened a new orebody in a raise above the 1,875 level. This is thought to be the downward extension of the orebody on the 1,750, and prospecting for the same ore will be carried on on the 1,875 level, 90 ft. below the top of the raise. In this property, ore has been opened on all levels from the 1,350th to the present new find. The Victoria and the adjoining Eagle & Blue Bell together—both controlled by the Bingham Mines—in July produced sixty cars of ore.

MONTANA

Butte Companies in Serious Need of Miners

Butte—Employment in the Butte mines probably is at the lowest level that it has been since the mines reopened. Most of the mines are operating with shifts reduced to the minimum. It is not expected that the situation will be improved until some time in October, when the operators hope for the return of miners who have spent the summer at other work.

The smelters at Great Falls and Anaconda are running at about the same capacity that they have been for the last few months, about 1,200 being employed in the Falls and around 2,200 at Anaconda.

Montana's mining industry has so far been unaffected by the coal strike, the Utah fields having been supplying enough for mining and smelting.

Helena—Operations were resumed Aug. 1 at the Scratch Gravel mine, which was once a gold producer. The work in hand is largely exploratory.

MICHIGAN

The Copper Country

Copper Shipments Large; Coal Shipments Very Small—Coal Famine Next Winter Possible

Houghton—Lake shipments of copper from the Michigan district continued during July to surpass those of a year ago. For three consecutive months shipments have passed 10,000,000 lb., the total for July being 10,322,000. In July a year ago the shipments were only 6,526,000 lb. The Calumet & Hecla mines shipped the bulk of the metal in July, sending 6,216,000 lb. from the Torch Lake docks and 800,000 lb. from Dollar Bay; there was shipped from Houghton, representing Copper Range, Mohawk and Wolverine copper, 2,170,000 lb.; and Quincy shipped 1,136,000 lb. The bulk of July business was domestic. Prospects of heavy shipments in August are good, for, in addition to domestic orders, Germany has come into the market for Lake copper.

The effect of the coal strike is reflected in the comparatively small receipts of bituminous coal in July, amounting to only 46,812 tons as against 104,860 tons in the corresponding month last year. No hard coal was received. The mines are four or five months short on their winter's supply, and there is considerable apprehension over the situation, although there are yet three months in which coal may be received by boat.

There is no immediate prospect for the reopening of Osceola, Allouez, and Centennial, subsidiaries of Calumet & Hecla, under present labor conditions. A prolonged period of idleness, however, will not be damaging to those mines, as there is no serious crushing in well-supported amygdaloid shafts. The North Kearsarge branch of Osceola has been placed in first-class condition since the shutdown, and is capable of larger production when operations are resumed. No. 1 shaft has been retimbered, and new tracks have been laid, the repairs requiring more than a year. Repairs also have been made in No. 4 shaft at the eighth level station.

At Mayflower-Old Colony, the drift on the 1,450 level, north, continues in vein matter. The drift on the 1,700 north, is still in trap and it may be necessary to do some cross-cutting to cut the vein again if the drills do not penetrate it by proceeding due north.

None of the Lake mines are affected by the rail strike, rock transportation continuing as usual.

MINNESOTA

Mesabi Range

Mesaba-Cliffs Company Will Load from Pit—Two Tracts Are To Be Drilled

Hibbing—Stockpile shipments from the Boeing mine, operated by the Mesaba-Cliffs Iron Mining Co., are being forwarded daily to the docks. It is anticipated that loading of ore from the open pit will be started in the near future.

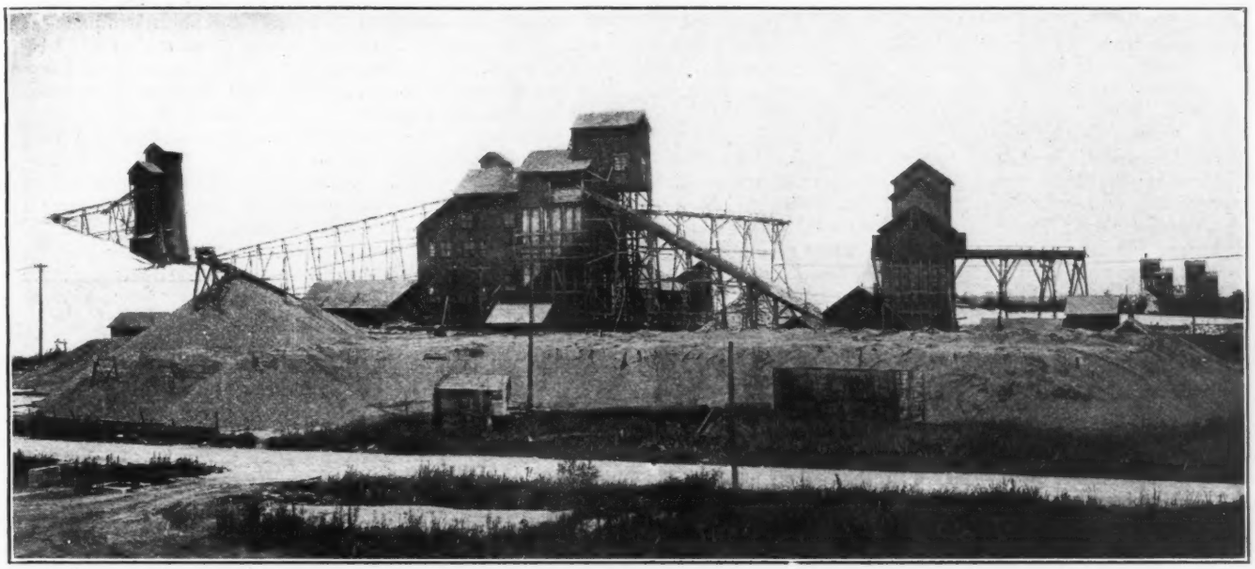
Active underground operations have again been started at the Pool mine by the Oliver Iron Mining Co. Not a large tonnage is contemplated from this property as the orebody is nearing exhaustion, and most of the work will consist of scramming.

Eveleth—The Oliver Iron Mining Co. is loading the stockpiles at the Geneoa and Spruce No. 4 mines. Ore operations at the Fayal and Spruce pits continues at a normal pace, with the operation of six and five shovels respectively.

Two drilling rigs have been moved to Sec. 34, 58-17 by the Carlson Exploration Co. which has contracted the drilling of two forty-acre tracts for a group of Detroit investors.

Virginia—A record production of 40,185 tons of ore was loaded out of the Missabe Mountain open pit, a property of the Oliver Iron Mining Co., during a twenty-four-hour period. This shipment consisted of 855 cars averaging 47 tons per car. The pit is enjoying the greatest production season since the first shipments were made.

Nashwauk—Preliminary work incidental to the contemplated stripping of the Shada mine has been started by the Clement K. Quinn & Co. This property was formerly known as the Pearson mine and was operated by underground methods, the product of which was washed by the mine's concentrator. The necessary drilling for the determination of pit limits is to be started.



Concentrate pile at the Webber mine, north of Picher, Okla. Estimated value, $800,000

JOPLIN-MIAMI DISTRICT

Pile of Zinc Concentrate Is Valued at Approximately $800,000

Joplin—On a lease just to the northwest of the McBee property, the Interstate Zinc-Lead Corp. has drilled a good-sized orebody and will at once begin the moving and erection of the Red Rose mill, recently purchased by it in Picher, to the new site. The Kanok Metals Co. and the Interstate Zinc-Lead Corp., though not the same company, have an interlocking directorate, and together have more than 2,000 acres of ground in this locality.

The accompanying illustration shows the pile of zinc concentrate at the Webber mine of the Commerce Mining & Royalty Co. It is much the largest 'ore' pile that the district has ever known. The company itself does not know exactly what it contains, but it is approximately 23,000 tons. At $35 a ton, the pile is worth more than $800,000. The mine has been paying operating expenses by its lead-ore production, it is reported, while it has been accumulating this big pile of zinc. Shovelers declare that it is "just like working in a 'jack' bin" to shovel in the Webber ground. It is one of the richest mines in the field. It is located in Kansas, west of the Vinegar Hill Zinc Co.'s Barr mine and north of the Kansas-Oklahoma line, north of Picher.

The Present Situation at the Mines

By Arthur B. Parsons
Assistant Editor, *Engineering and Mining Journal-Press*

NOT difficulties arising from the coal and rail strikes, but the inability to obtain an adequate number of competent miners, is the outstanding feature of the situation in the mining industry today. While grave anxiety is expressed in some quarters regarding coming weeks and months, it is impossible to find any instance in which current production has been affected appreciably either by a lack of fuel for power-plant or smelting purposes, or by inadequate transportation facilities for moving ore. In the West, hydro-electric and fuel-oil power plants supply a good proportion of the requirements, and in addition coal is obtainable from the non-union fields. In the states farther east, including the Michigan copper country, Wisconsin, and the Tri-State lead-zinc region, the outlook for the winter is not good.

The feature of the shortage of competent miners is the fact that complaint is made on nearly every hand. Emphasis is placed on the word "competent." Western operators are appreciating more than ever the fact that common laborers don't make miners. The real miner is something of a skilled workman. In the Michigan copper country, Calumet & Hecla is contracting its stoping and tramming, and has enough men. The other companies are short handed. Definite shortage of labor is reported from Alabama, Minnesota, the Joplin-Miami district, Arizona, Colorado, Montana, Idaho, Nevada, and California. It is a well-known fact that many men who are essentially miners are accustomed to spend a few months during the summer at outside work, returning to the mines in the fall. This year, however, it is difficult to gage the importance of this factor.

Incidentally, there is a possibility that the shortage of miners is a blessing in disguise. It is conceivable that if more good men were available the production would be so largely increased as to affect the metal market unfavorably. The gradual improvement in prices for copper, zinc, and lead is a cause for optimism among producers, but a large increase in output might easily be a disturbing factor.

Wages of smelter employees have just been raised in Utah making minimum rate for common labor $3 per day. At Winthrop, Cal., a 25c. increase by the Shasta Zinc & Copper Co. makes the basic wage scale for miners $4.25 per day.

Apparently, a low point in the wage curve has been passed; the same is true of commodity prices, Dun's latest index being $173.558, as compared with $164.444 on Jan. 1, and $169.977 on June 1. Reduction of production costs in the immediate future will depend upon economies effected by more efficient management and the thinner spreading of overhead through increased rates of output.

Copper production is increasing slowly. United Verde is increasing its rate of output. Greene-Cananea, following remodeling of its plants, resumed mining on Aug. 1, but little copper will reach the market for at least a month. The company has a productive capacity of 5,000,000 lb. per month. The Anaconda company is increasing the output of its Walker mine, in Plumas County, Cal., to 100 tons of shipping ore and 100 tons of concentrate. The International Smelter, at Miami, produced 17,500,000 lb. of blister in July, an increase of 1,000,000 over June. Nevada Consolidated, whose concentrator was destroyed on July 9, will scarcely be able to maintain its present rate of production after the stock of concentrate on hand is exhausted, although high-grade ore from the Ruth mine can be mined rapidly enough to keep in operation several furnaces at the smelter. The following figures indicate the estimated monthly rate of current production by some of the larger companies:

Utah Copper	8,500,000	Miami	6,000,000
Inspiration	5,500,000	Arizona Commercial	700,000
Anaconda	16,000,000	Old Dominion	2,000,000
Calumet & Hecla	4,000,000	North Butte	800,000
Ahmeek	1,350,000	Granby Consolidated	2,500,000
Copper Range	2,000,000	Engels	1,250,000
Quincy	800,000	Chino	3,000,000
Mohawk	800,000	Ray Consolidated	3,000,000
United Verde Extension	3,000,000	Phelps Dodge	9,000,000
Calumet & Arizona	3,500,000	United Verde	5,000,000
New Cornelia	3,000,000	Nevada Consolidated	2,000,000

Zinc production likewise is increasing slowly. Anaconda has just restarted its Emma mine, which has been closed since early in 1921. The limited supply of labor is said to restrict production in the Wisconsin and Joplin-Miami districts; in the latter field some mines were reopened and were then compelled to suspend because of inability to get men.

Gradually increased activity in lead mining is also apparent. The Tamarack & Custer and Hercules mines, in the Coeur d'Alene district of Idaho, are resuming, although they have so far obtained less than half of the 600 men required. The Bunker Hill company is ready to start a second lead furnace. At Tooele, Utah, two lead furnaces have recently been blown in; and increased output is reported from Colorado lead smelters, due to ore shipments from new producers. Three lead furnaces are in blast at El Paso, Tex.

The output of refined copper from the Lake district in July totaled 9,750,000 lb., exceeding June by 250,000 lb. Mine, mill and smelter payrolls total 5,500 men, as compared with 16,000 in 1917. Current coal receipts are so small that a serious shortage threatens next winter.

Sixty per cent zinc concentrate in Wisconsin is bringing $40 per ton; some operators are awaiting settlement of the coal and rail strikes before resuming. The stock of zinc concentrate is 4,000 tons; no lead is on hand.

In the Joplin-Miami district 105 operating mines are producing 10,000 tons of 60 per cent zinc concentrate weekly. Shortage of miners prevents increased output that would be the normal consequence of advancing prices.

Gold output from the Homestake and Trojan mines, in the Black Hills, in South Dakota, is at the rate of $750,000 monthly. Small operators are active. The district is unaffected by the big strikes.

At Jerome, in Arizona, the United Verde company is starting a new reverberatory, and is completing preparations for heap-leaching; 150 men are being added to the payroll. New Cornelia will produce 3,000,000 lb. of copper monthly from its leaching plant at Ajo, but will ship no high-grade ore to the smelter at Douglas. Two hundred men have been added to the working force at Ajo. The old Dominion is increasing the capacity of its 700-ton mill 35 per cent.

Little change is noted in Utah. The Utah Consolidated is milling 500 tons of Bingham copper ore at the new plant at Tooele. Utah Copper is shipping 15,000 tons daily to Garfield. Three holidays in July reduced July ore shipments from both the Tintic and Park City districts, but there is nothing significant in the cut.

The Butte district in Montana, and the Coeur d'Alene, in Idaho, seem to be in almost equal distress for lack of competent miners. The starting of the Tamarack and Hercules mines, in the latter district, has merely taken men from the other mines in the vicinity. Wages are $4 for muckers and $4.25 for miners. The labor shortage is one factor that deters the zinc operators from resuming. The Bunker Hill, Federal, and Hecla mines are producing at the rate of 6,000, 5,000, and 4,000 tons monthly. Outside of the starting of the Emma mine little change is noted at Butte.

New properties are entering the shipping lists at the Durango and Leadville smelters, and output is increasing. A shoot of high-grade gold ore has been opened for 100 ft. in the Portland mine, at Cripple Creek. Miners are needed.

In California the Engels Copper Co. consistently ships around 1,250,000 lb. per month in the form of concentrate to the Garfield smelter. Gold mining on the Mother Lode and at Grass Valley continues active.

Marked increase in activity in British Columbia is indicated by the large number of new shippers to the smelters. Important new discoveries are reported at the Florence mine, near Ainsworth, and from the Salmon River district.

The comparatively good price for silver is reflected in activity at Cobalt, in Ontario. The current gold production of the province is at the rate of $21,000,000 per year, which is 20 per cent higher than for 1921.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
3	13.75	32 25	32 125	5.75	5.50	6.20@6.25
4	13.75	32 25	32 375	5.75	5.50	6.25
5	13.675@13.825	32 25	32 375	5.75	5.50	6.25
7	13.675@13.825	32 25	32 50	5.75@5.80	5.50@5.525	6.20@6.25
8	13.675@13.825	32.25	32.50	5.75@5.80	5.50@5.525	6.20@6.25
9	13.675@13.825	32.125	32.25	5.75	5.525	6.20@6.25

*These prices correspond to the following quotations for copper delivered: Aug. 3d and 4th, 14c.; 5th to 9th inclusive, 13.925@14.075c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
3	65¾	65⅜	71	159⅛	159⅛	25⅜	24½	31½	31⅛
4	65⅛	65⅛	71	160⅞	160⅞	25⅜	24½	31⅝	31
7	...	...	..	.....	.....	...	...	...	...
8	65⅛	65⅛	71	161⅛	161⅛	25⅛	24⅛	31⅛	30¾
9	64⅝	64¾	71	160⅛	160¼	25⅛	24⅛	31¼	30⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
3	4.44¼	99⅜	69½	35⅛	7	4.46	99⅜	69¾	Holiday
4	4.45	99⅝	69⅝	35⅛	8	4.45⅞	99⅝	69½	34⅞
5	4.45¼	99⅝	69⅝	35⅛	9	4.45⅝	99⅜	69	34¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Metal Markets

New York, Aug. 9, 1922

The metal markets remain quiet. Copper, lead, and zinc have been in fair demand, the chief activity being in the lead market. Copper business is slightly better, but the demand for zinc has become easier, owing to the strike situation, which continues to act as a damper to the metal trades. Producers are earnestly hoping for an early settlement of the labor troubles, which they generally feel to be a disturbing element in the market and hindering a larger demand for the metals.

Copper

Although sales of copper were heavier this week than for the week previous, the improvement is slight. Some producers report an even duller market than usual. Both domestic and export business has increased in volume, and some producers who are members of the Export Association have been content with their proportion of export business and have preferred not to force the domestic market. Sales were made generally on a 14c. delivered basis during the week. Last Friday, however, an order for several million pounds was booked at 13.675c. refinery. It might be possible to shade 14c. today, but only slightly, if at all. On the other hand, we have a record of sales in heavy tonnages made to net 13.93c. refinery for copper for delivery through December. As a rule, sales were confined to delivery within the next two and three months. The large majority of producers are asking 14c., and it is easy to obtain copper on that basis delivered. The market seems satisfactory, considering the strike conditions under which it is working. Consumption is taking place at a good rate, and all classes of copper manufacturers are busy. Compared with last August, which was one of the worst months the copper industry ever experienced, the improvement is striking.

Export business suffers from the lack of German buying, but England, France, and other European countries have partly made up for the void. Foreign sales have netted about 13.96c. refinery.

Lead

The official contract price of the American Smelting & Refining Co. continues at 5.75c. per lb. New York.

Lead is in a strong position, and the demand for the metal is unabated. Sales for the week were good. In New York common metal was sold for 5.75c. throughout the week and corroding grades $2 per ton higher. Demand, as usual, was well diversified among the various classes of consumers, and sales were made in many points in the East and Middle West. Two producers were able to obtain higher prices than 5.75c. New York, but metal is still available at the lower level in good-sized tonnages. The market in St. Louis has shown a slightly rising tendency, narrowing the differential between the two markets. Today metal can be had at 5.525c., although some producers are quoting higher prices, 5.55c. and 5.75c. The long standing tariff difficulty between France and Spain was reported settled two weeks ago, so that now Spanish lead is again free to enter the French market. As a result Mexican lead, which has been favored in France, has been meeting active competition there and has been seeking other European markets. It has been estimated that current consumption of lead in the United States is about 10,000 tons in excess of the current production.

Zinc

The demand for zinc has declined slightly, which has been attributed to the effect of the coal strike. However, consumers have also felt the influence of the strike; in fact, they have been troubled more than the galvanizers,

Inquiry for the metal has fallen off, and an easier tendency for prices is discernible. Earlier in the week zinc was sold for 6.25c., but today the metal can be obtained for 6.20c., although several producers are asking higher prices. The lull in buying is not disturbing producers, who are generally well sold out of metal. High-grade zinc has been in excellent demand by the brass mills, and has sold for 7.25c. per lb. with 30c. per 100 lb. freight allowance.

Tin

The market has been active, but the tin-plate manufacturers remain out of the market, as they have for the last four weeks. They have been seriously affected by the strike. The shortage of spot 99 per cent tin continues, and the prices quoted for that grade are largely nominal. It appears that the shortage of 99 per cent will not be over until the end of August or early in September. Forward Straits tin is quoted at about ¼c. above spot.

Arrivals of tin in long tons: Aug. 3d, England, 75; 7th, Straits, 955; Java, 100.

Gold

Gold in London: Aug. 3d, 92s. 9d.; 4th, 92s. 8d.; 8th, 92s. 5d.; 9th, 92s. 6d.

Foreign Exchange

The European exchanges showed irregularity during the week. The uncertain outcome of the London conference is having an effect on rates. Crippled cable service has also been responsible. On Tuesday, Aug. 8th francs were 8.15c.; lire, 4.59c.; marks, 0.1324c.; Canadian exchange, ¼ per cent discount.

Silver

The silver market in London has continued to show a downward tendency, but New York has held fairly steady on the strength of sterling exchange and the scarcity of offerings. A temporary inquiry for San Francisco delivery arose the latter part of last week, but this demand was not sustained.

Mexican Dollars—Aug. 3d, 53⅛; 4th, 53¼; 5th, 53¼; 7th, 53¼; 8th, 53⅛; 9th, 52⅞c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—20.10c. per lb. for 99 per cent grade; 19.10c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.75@18.25c. for 98@99 per cent virgin grades.

Antimony — Chinese and Japanese brands, active and firm at 5.25c. W.C.C., 6@6.25c. Cookson's "C" grade, 7@7.50c.

Bismuth—$2@$2.10 per lb.

Cadmium—$1.20@$1.25 per lb.

Iridium—$180@$185 per oz., New York; $160 in Middle West.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 31@33c. per lb.

Palladium—$55 per oz.

Platinum—$93 per oz. Strong.

Quicksilver — $55@$57 per 75-lb. flask. Market active. San Francisco wires $55.30. Strong.

Selenium—$1.75@$1.85 per lb.

The prices of **Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Thallium** and **Tungsten** are unchanged from prices given Aug. 5.

Metallic Ores

Manganese Ore—29c. per long ton unit, seaport.

Iron Ore, Chrome, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Aug. 5.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 5—Zinc blende, per ton, high, $38.30; basis 60 per cent zinc, premium, $37@$37.50; Prime Western, $36; fines and slimes, $35@$33; average settling price, all grades of blende, $36.30.

Lead, high, $81.85; basis 80 per cent lead, $78.50; average settling price, all grades of lead, $80.21 per ton.

Shipments for the week: Blende, 6,090; lead, 793 tons. Value, all ores the week, $284,800.

Unable to obtain cars for shipping, the ore demand dropped one or two thousand tons, but prices remained unchanged. Sellers would accept no lower offerings and would not sell at last week's prices until late today, when it became evident that buyers were seeking little ore and would not pay more. Producers of zinc ore advanced pay to all employes 25c. per day beginning this week. According to former arrangements this was not due until blende sold for $40 per ton. Producers are of the belief that slab zinc now warrants $40 and that this will be paid as soon as the rail strike is settled.

Platteville, Wis., Aug. 5—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $80 per ton. Shipments for the week: Blende, 380 tons; lead none. Shipments for the year: Blende, 9,528; lead, 1,129 tons. Shipped during the week to separating plants, 713 tons blende.

Non-Metallic Minerals

Barytes—Washed crude, 92 per cent $BaSO_4$ guaranteed, $8@$9 per long ton, f.o.b. Georgia points; off-color ground No. 1 grade, $20; No. 2 grade, $15.

Feldspar—No. 1 pottery grade, $6.50 @$7.50 per long ton; soap grade, $7, f.o.b. North Carolina points. Ground to 140 mesh, $16.50 per ton; 40 to 100 mesh, $10, f.o.b. mill. Maine producer reports pottery grade at $18. Canadian, $20, f.o.b. cars at mill.

Talc—200 to 300 mesh, including containers, $13.50@$14.75, f.o.b. New York state mills. In California, 200 mesh, $16@$18 per short ton; 300 mesh, $25@$30, bags extra at cost.

Asbestos, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, and Sulphur are unchanged from the prices published Aug. 5.

Mineral Products

Arsenious Oxide (white arsenic)—7.50c. per lb.

Copper Sulphate—Large crystals, 6.50c. per lb.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of Aug. 5.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and Ferrovanadium are unchanged from the prices published Aug. 5.

Metal Products

Copper Sheets—New York base, 21c. per lb.; wire, 15.50@15.75c. net.

Nickel Silver—28c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 18.75c.; rods, 15.75c. per lb.

Lead Sheets and **Zinc Sheets** are unchanged from the quotations published in the Aug. 5 issue.

Refractories

Magnesite Brick—$56 per net ton.

Magnesite Cement — $35@$40 per ton.

Silica Brick—$33@$41 per 1,000, f.o.b. shipping points.

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, and Zirkite are unchanged from the prices appearing in the issue of Aug. 5.

The Iron Trade

Pittsburgh, Aug. 8, 1922

Production of pig iron and steel has decreased farther, as a result of fuel conditions, and in all probability will continue decreasing for two or three weeks after the coal strike is formally settled. Mills and byproduct coke plants are exhausting their stocks, and little coal will go to the iron and steel industry until more important consumers are supplied.

There is no direct measure of the decrease in steel consumption caused by scarcity of coal, but it is known that some consumers have instructed mills to cease shipment. The quietness in the steel market and the small volume of demand for prompt deliveries indicate that consumption of steel is affected nearly if not quite as much as production. There is buying of prompt steel at premiums, $2 to $5 a ton, but no large tonnage.

Pig Iron—The pig-iron market is now one of small lots for prompt shipment, there being no semblance of a forward market. For prompt, we quote bessemer at $26 and foundry at $27, Valley, basic being nominal at $25, the price on sales about ten days ago.

Connellsville Coke—Demand is light and is practically confined to foundries. Furnace, $13.40@$14; foundry, $15@ $15.50; Connellsville steam coal, $7@ $7.50.

COMPANY REPORTS

The Lucky Tiger Combination Gold Mining Co.

Silver, gold; Mexico

A report of operations of the Lucky Tiger Combination Gold Mining Co. for 1921 shows a net profit of $959,172.76 before depletion, according to the following profit and loss account in U. S. gold:

Concentrate sales		$2,206,135.26
Operating costs		1,205,017.29
Net operating profit		$1,010,117.57
General income		72,931.13
		$1,074,048.70
General expenses		89,184.67
Net realization		$984,864.03
Less depreciation		25,691.27
Consolidated net profit		$959,172.76

Balance sheet as of Dec. 31, 1921, follows:

ASSETS

Tigre Mining Co., S. A., of Mexico stock revaluation of original nominal value of entire capital stock as determined by the board of directors of the Lucky Tiger-Combination Gold Mining Co., May 10, 1909	$6,507,500.00	
Less depletion	3,780,694.87	$2,726,805.10
Cosmos Mine investment		2,972.60
Gilmore lease		1.00
Apache Powder Co. stock		6,000.02
Real estate and residence, Douglas, Ariz.		8,932.42
Furniture and fixtures		350.08
Cash		55,412.50
United States securities		1,110,000.00
Notes receivable		27,500.00
Accounts receivable		847.17
Interest accrued		22,239.81
Development sinking fund		390,506.76
Due from the Tigre Mining Co., S. A.		1,148.15
Deferred charges		3,051.50
		$4,355,767.06

LIABILITIES

Due to stockholders:		
Capital stock:		
Authorized	$8,000,000.00	
Less unissued	846,630.00	$7,153,370.00
Realization:		
Balance, Jan. 1, 1921	$8,094,222.79	
Realized during year ended Dec. 31, 1921	133,746.46	
	$8,227,969.25	
Less depletion (Tigre Mine)	$3,780,694.87	$4,447,274.38
		$11,600,644.38
Less dividends distributed		8,227,830.11
		$3,372,814.27
Accounts payable		2,862.06
Drafts outstanding		13,942.41
Due to the Tigre Mining Co., S. A.		965,946.06
Reserve for State of taxes		202.26
		$4,355,767.06

Production amounted to 75,243 tons of ore, assaying 0.21 oz. gold, 9.3 oz. silver, 0.38 per cent copper, and 1.23 per cent lead. Cost per ton was $1.85 for development; $3.26 mining; $3.15 milling; $0.89 general; and $7.31 marketing; total $16.46.

The Waihi Gold Mining Co., Ltd.

Gold; New Zealand

A report of operations of the Waihi Gold Mining Co., Ltd., for 1921 states that during the year 164,042 tons (of 2,000 lb. dry weight) was treated. The gold and silver sold realized £307,972 6s. 10d. In addition a special cleanup of the refinery produced £40,322 6s. 5d. Interest (including £4,306 0s. 2d. income tax deducted therefrom) and sundry receipts amounted to £26,344 18s. 10d. The value of the power supplied by the Government of New Zealand in pursuance of the terms of purchase of the Hora Hora undertaking and included in the power costs of the different departments was £10,625, making a total of £385,264 12s. 1d. The expenditure in New Zealand and London, including development work at the mine, amounted to £278,670 16s. 4d., leaving a balance of £106,593 15s. 9d. The above sum, added to the balance of £14,159 7s. 5d. brought forward from the preceding accounts, makes a total of £120,753 3s. 2d.

Two quarterly dividends of 6d. each, and one half-yearly of 1s., free of tax, were paid on March 1, June 1, and Dec. 1, amounting to £49,590 14s., equal to a distribution of 2s. per share, or 20 per cent on the reduced capital of the company, free of tax. The heavy sum of £46,140 8s. 2d. has been reserved for income tax and corporation profits tax in London and New Zealand for the year 1921. The sum of £14,138 has been written off for depreciation on plant and machinery.

After all appropriations the balance remaining to the credit of revenue account at Dec. 31 was £10,884 1s., which the directors recommend should be carried forward.

St. John Del Rey Mining Company, Ltd.

Gold; Brazil

A report of operations of St. John Del Rey Mining Co., Ltd., for the fiscal year beginning March 1, 1921, shows a profit of £257,224. Production amounted to 169,234 tons, of which 167,200 were milled, yielding 121,811.4 oz. of gold, and silver to the value of £4,750. Operating results follow:

Morro Velho gold	£520,044	
Morro Velho silver	4,750	
	£524,794	
Premium realized on sale of gold	121,358	
	£646,152	
Less government duties and transport charges	15,825	£630,327
Working cost in Brazil	£346,987	
Developments in the mine	13,722	
London expenses	12,394	373,103
		£257,224
Amount brought forward from last account		18,585
		£275,809
Interim dividends on the preference and ordinary shares, paid Dec. 15, 1921	£27,628	
Proposed final dividends on preference and ordinary shares, payable June 30, 1922, making 10 per cent per annum, free of tax, upon the 10 per cent preference shares, and 10 per cent per annum, less tax, upon the ordinary shares	41,118	
Proposed bonus of 1s. per share on ordinary shares for the year ended Feb. 28, 1922	27,313	
Balance of income tax and corporation profits tax	39,079	135,138
		£140,671
Transferred to capital works account	£70,000	
Transferred to reserve fund	30,000	
Balance carried forward	40,671	£140,671

The tonnage crushed, though below the average, shows an advance of 21,400 tons over that of 1920-21. Comparison with the figures of the preceding years shows a decrease of £5,453 in the premium obtained, but a satisfactory increase of £101,691 in the amount of bullion, the gold being taken at its par value.

This improvement was due partly to the larger tonnage and partly to the rise in the yield of the mineral, which was 62s. 9¼d. per ton at par value as compared with 57s. 7¾d. in 1920-21. The company had also the advantage during the year of an unusually low exchange, which averaged for its drafts 7.87d., the rate for the preceding year being 13.17d.

New York & Honduras Rosario Mining Co.

Gold; Honduras

A report of operations of New York & Honduras Rosario for 1921 shows a deficit of $184,420.64 according to the following income profit and loss statement:

Production of gold and silver		$466,956.02	
Less freight and expenses on bullion		22,944.61	
Operating income			$444,011.41
Operating expenses		$344,716.01	
Non-operating expenses		182,646.11	
			527,362.12
Operating loss			$83,350.71
New York administrative expenses			43,520.55
Net loss from operating			$126,871.26
Other income			46,305.78
			$80,565.48
Other deductions			30,302.96
Net loss for year			$110,868.44
Appropriated for reserves:			
Ore depletion		$66,574.17	
Fire and transit insurance		6,978.03	
			73,552.20
Deficit for year carried to surplus			$184,420.64
Surplus: Jan. 1, 1921		$1,403,204.39	
Additions:			
Canceling reserve for exchange fluctuation	$129,993.25		
Increasing value of Liberty bonds to market, Dec. 31, 1921	24,898.81		
Adjusting reserve for depletion, prior years	439,667.43		
Adjustment of sundry accounts	3,183.14		
	$597,742.63		
Deductions:			
Dividends paid during 1921	$60,000.00		
Increasing reserve for Federal income and profits taxes, prior years	$150,000.00		
	$210,000.00		
		387,742.63	
			$1,790,947.02
Surplus—Dec. 31, 1921			$1,606,526.38

Balance sheet as of Dec. 31, 1921, is as follows:

ASSETS

Permanent:			
Mines, real estate and concessions		$3,000,000.00	
Plant, buildings, machinery and equipment		$1,232,054.55	
Less depreciation	615,162.00		
		616,892.55	
			$3,616,892.55
Current:			
Cash		$32,458.52	
Call loans receivable plus interest		251,111.09	
Bullion on hand at mine, at market		1,144.54	
Broken ore in stopes and mill bins at cost		114,217.38	
Materials and supplies at cost		308,464.11	
U. S. securities at market, plus interest		333,432.19	
Foreign Government bonds at cost, plus interest		25,176.37	
Domestic railroad bonds at cost, plus interest		49,876.50	
Sundry accounts receivable		60.49	
			1,115,941.19
Other assets:			
Investments in stocks of other companies		51,853.00	
Advances to other companies less reserve		59,888.13	
Miscellaneous accounts receivable		6,571.44	
Claims receivable		7,016.75	
			125,329.32
Deferred charges:			
Prepaid insurance, taxes and expenses			53,156.39
Total assets			4,911,319.45

LIABILITIES

Current:			
Drafts payable	$15,409.97		
Accounts payable	904.23		
		$16,314.20	
Miscellaneous deposits—Honduras		2,073.00	
Federal income and profits taxes, prior years (estimated)		200,000.00	
			$218,387.20
Reserves:			
Mine fire insurance		$27,708.89	
Transit insurance		2,527.62	
Depletion of mines		1,056,169.36	
			1,086,405.87
Capital stock:			
Authorized and issued: 200,000 shares			
Par value $10 per share		$2,000,000.00	
Surplus:			
Appreciation of mine valuation less depletion	$1,123,198.18		
Earned surplus	483,328.20		
		1,606,526.38	
			$3,606,526.38
			$4,911,319.45

Production amounted to 43,920 dry tons, milled, yielding 657,250 oz. silver and 3,325 oz. gold from Jan. 1 to April 22, 1921, when operations were stopped.

Movements of Ores and Metals in June

Imports and exports of some of the more important meta's and ores during June, 1922, with comparative figures, as finally revised, for June of 1921, as compiled by the Bureau of Foreign and Domestic Commerce, are as follows:

IMPORTS, JUNE 1921 AND 1922

In Pounds, Unless Otherwise Stated

	June, 1921	June, 1922
Antimony matte, regulus or metal	3,367,600	510,120
Copper		
Ore, contents	3,996,171	4,858,839
Concentrates, contents	34,317	1,930,425
Matte and regulus, contents	1,098,577	1,386,616
Imported from, in part		
Spain	270,407	274,000
Canada	383,737	519,293
Mexico	340,712	135,559
Chile	3,200,931	4,214,393
Peru	81,176	67,365
Unrefined, black and blister	12,531,637	14,596,714
Refined, in bars and plates	2,812,467	27,473,805
Old, for remanufacture	59,432	848,186
Composition metal, copper chief value	434,450	.....
Lead		
Ore, contents	688,585	537,391
Bullion, contents	5,581,766	3,002,796
Imported from, in part		
Canada	227,583	1,295
Mexico	5,775,272	3,531,053
Other countries	267,496	7,839
Pigs, bars and old	17,442,890	17,956
Manganese ore, long tons	17,169	44,329
Imported from, in part		
Cuba, long tons	.....	.....
Brazil, long tons	9,600	31,026
British India, long tons	7,560	1,000
Tungsten ore, long tons	216	280
Pyrites, long tons	17,861	9,414
Imported from		
Spain, long tons	17,861	9,414
Canada, long tons	.....	.....
Tin ore, long tons	1,891	887
Tin bars, blocks and pigs	4,133,450	12,552,329
Imported from, in part		
United Kingdom	1,098,846	1,626,395
British Straits Settlements	2,644,643	10,048,657
Dutch East Indies	.....	851,523
Australia	56,000	22,400
Zinc		
Ore, contents	268,387	143,777
Imported from		
Mexico	241,678	143,777
Canada	19,703	.....
Blocks, or pigs, and old	6,203	37,500

EXPORTS OF COPPER, LEAD AND ZINC

In Pounds

	June, 1921	June, 1922
Copper		
Ore, concentrates, matte and regulus	.....	6,832
Unrefined, black and blister	.....	525
Refined, in ingots and bars	48,790,746	58,732,141
Exported to, in part		
Belgium	1,794,449	3,033,438
France	7,310,557	11,280,279
Germany	22,709,637	14,144,238
Italy	278,526	3,656,397
Netherlands	2,658,659	4,289,230
United Kingdom	2,826,296	10,319,933
Japan	5,628,000	1,220,658
Composition metal, copper chief value	631	4,592
Old and scrap	.....	211,370
Pipes and tubes	129,523	97,398
Plates and sheets	159,561	360,128
Wire, except insulated	1,310,213	978,781
Lead		
Pigs and bars		
Produced from domestic ore	63,059	336,932
Produced from foreign ore	2,800,204	684,107
Exported to		
United Kingdom	.....	392,217
Canada	8,960	24,892
Brazil	.....	448,115
China	310	2,498
Japan	2,800,000	.....
Other countries	53,993	153,317
Zinc		
Dross	.....	861,852
Spelter		
Produced from domestic ore	201,328	9,208,199
Produced from foreign ore	336,000	650,008
Exported to		
France	.....	1,948,913
United Kingdom	.....	4,366,926
Canada	67,032	169,334
Mexico	69,021	71,515
Argentina	.....	268,951
Japan	393,730	1,008,064
Other countries	7,545	2,024,504
In sheets and strips	338,404	573,174

MINING STOCKS

Week Ended Aug. 5, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	64	63½	64	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	2⅜	2⅛	2⅛		
Allouez	Boston	†26	†25	25½	Mar. '19	1.00
Anaconda	New York	53¾	53	53⅜	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3⅞	3⅜	3⅜		
Ariz. Com'l	Boston	9	8⅛	8⅛	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*12	*10	*11		
Bingham Mines	Boston	14½	14½	14½	Sept. '19, Q	0.25
Calumet & Arizona	Boston	61	60	60⅜	June '22, Q	0.50
Calumet & Hecla	Boston	287	275	287	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*23	*16	*20		
Centennial	Boston	9½	9⅜	9⅜	Dec. '18, SA	1.00
Cerro de Pasco	New York	38½	37⅜	38	Mar. '21, Q	0.50
Chile Copper	New York	22⅜	21⅞	22⅛		
Chino	New York	30½	29⅜	30	Sept. '20, Q	0.37½
Columbus Rexall	Salt Lake	*34	*29½	*33½		
Con. Arizona	N. Y. Curb			*3	Dec. '18, Q	0.05
Con. Copper Mines	N. Y. Curb	*60	*50	*60		
Copper Range	Boston	44½	42⅜	42⅞	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅛	*90	1		
Davis-Daly	Boston	8	7⅛	7⅛	Mar. '20, Q	0.25
East Butte	Boston	10⅜	10⅛	10⅛	Dec. '19, A	0.50
First National	Boston Curb	*60	*60	*60	Feb. '19, SA	0.15
Franklin	Boston	2⅜	2	2		
Gadsden Copper	Boston Curb	85	85	85		
Granby Consol.	New York	30	30	30	May '19, Q	1.25
Greene-Cananea	New York	30⅛	30⅛	30⅛	Nov. '20, Q	0.50
Hancock	Boston	†3	†2½	†2½		
Howe Sound	N. Y. Curb	3⅛	3	3	Jan. '21, Q	0.05
Inspiration Consol.	New York	41¼	40⅜	40⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	†7	†6⅜	7	Sept. '20, K	0.25
Isle Royale	Boston	25	25	25	Sept. '19, SA	0.50
Kennecott	New York	36⅛	35⅛	36	Dec. '20, Q	0.50
Keweenaw	Boston	3	3	3		
Lake Copper	Boston	5	4⅛	4⅛		
La Salle	Boston	†2⅛	†1⅛	1⅛		
Magma Copper	N. Y. Curb	27⅛	27¼	27⅛	Jan. '19, Q	0.50
Majestic	Boston Curb	†*10	†*5	*10		
Mason Valley	Boston	2	1⅞	1⅞		
Mass. Consolidated	Boston	3¼	3⅛	3⅛	Nov. '17, Q	1.00
Miami Copper	New York	29⅜	29⅛	29⅛	May '22 Q	0.50
Michigan	Boston	1⅜	1⅛	1⅜		
Mohawk	Boston	61⅛	60⅜	61	July '22, Q	1.00
Mother Lode Coa.	N. Y. Curb	10⅛	9⅛	9⅞	June '22, I	0.50
Nevada Consol.	New York	17	16⅛	17	Sept. '20, Q	0.25
New Cornelia	Boston	19¾	19	19⅛	May '22, K	0.25
North Butte	Boston	12⅜	12⅛	12⅛	Oct. '18, Q	0.25
North Lake	Boston					
Ohio Copper	N. Y. Curb	*10	*8	*8		
Old Dominion	Boston	25⅛	25⅛	25⅛	Dec. '18, Q	1.00
Osceola	Boston	36⅛	35	36	June '20, Q	0.50
Phelps Dodge	Open Mar.	†175	†160		July. '22, Q	1.00
Quincy	Boston	43⅜	43	43⅜	Mar. '20, Q	1.00
Ray Consolidated	New York	16⅜	16⅛	16⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅞	1⅝	1⅞		
St. Mary's Min. Ld.	Boston	46	46	46	Apr. '22, K	2.00
Seneca Copper	Boston			12½		
Shannon	Boston	*85	*75	*80	Nov. '17, Q	0.25
Shattuck Arizona	New York	10	9⅛	10	Jan. '20, Q	0.25
South Lake	Boston	†1⅛	†*85	1		
Superior & Boston	Boston	1⅜	1⅛	1⅛		
Tenn. C. & C. cfs	New York	10⅜	10⅛	10⅛	May '18, I	1.00
Tuolumne	Boston	*74	*70	*74	May '13,	0.10
United Verde Ex.	Boston Curb	28	27⅛	27⅛	Aug. '22, Q	0.25
Utah Consol.	Boston	2⅜	2⅛	2⅛	Sept. '18,	0.25
Utah Copper	New York	66	64⅛	64⅛	June '22, Q	0.50
Utah Metal & T.	Boston	1 1/16	1 1/16	1 1/16	Dec. '17,	0.30
Victoria	Boston	†2	†1⅜	1⅜		
Winona	Boston	1⅜	1⅜	1⅜		
Wolverine	Boston	11⅛	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	18	17⅛	17⅛	Mar. '19,	0.50
Internat. Nickel, pfd	New York	†83	†72	83⅛	Aug. '22, Q	1.50
LEAD						
National Lead	New York	101⅜	100⅛	101⅜	June '22, Q	1.50
National Lead, pfd	New York	111⅛	111	111⅛	June '22 Q.	1.75
St. Joseph Lead	New York	15⅜	15	15⅜	June'22, Q	0.25
QUICKSILVER						
New Idria	Boston	*15	*10	*10		
ZINC						
Am. Z. L. & S.	New York	18⅛	17⅛	17⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York			45	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅜	6⅞	7⅛	June '18,	0.50
Butte & Superior	New York	31⅜	29¾	30⅛	Sept. '20,	1.25
Callahan Zn-Ld	New York	8⅜	8	8	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	144⅜	142⅛	144⅜	May '22, Q	2.00
Yellow Pine	Los Angeles	*55	*55	*55	Sept. '20, Q	0.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	⅜	⅜		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Atlas	Toronto	*24½	*23½	*24		
Carson Hill	New York	10½	10½	10½		
Cresson Consol. G.	N. Y. Curb	2 3/16	2⅛	2 1/16	July '22, Q, X	$0.10
Dome Mines	New York	31	29½	31	July '22, Q	.50
Florence Goldfield	N. Y. Curb	*12	*12	*12		
Golden Cycle	Colo. Springs	1	*96	1	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*6	*6	*6	Dec. '19,	0.05
Gordon Murray	Toronto			*30		
Hollinger Consol.	Toronto	10.25	9.45	10.15	July '22,	0.05
Homestake Mining	New York	71	71	71	July '22, M	0.25
Keora	Toronto	*13½	*11½	*13		
Kirkland Lake	Toronto	*39	*36	*38		
Lake Shore	Toronto	2.30	2.20	2.27	Nov. '21, K	0.02
McIntyre-Porcupine	Toronto	17.00	16.70	17.00	May '22, K	0.05
Porcupine Crown	Toronto	*26	*23½	*24	July '17,	0.03
Porcupine V. N. T.	Toronto	*22½	*18½	*20		
Portland	Colo. Springs	*40	*38	*38	Oct. '20, Q	0.01
Schumacher	Toronto	*75½	*74½	*75		
Silver Pick	N. Y. Curb	*10	*10	*10		
Teck Hughes	Toronto	*64	*60½	*63½		
Tom Reed	Los Angeles	*93	*56	*85	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/16	1 1/16	1⅛	July '22, Q	0.15
Vindicator Consol.	Colo. Springs	*4¼	*4¼	*4¼	Jan. '20, Q	0.01
White Caps Mining	N. Y. Curb	*8	*5	*5		
Wright-Hargreaves	Toronto	3.00	2.75	2.85	July '22,	0.02½
Yukon Gold	N. Y. Curb	1	*95	*95	June '18,	0.02½
SILVER						
Batopilas Mining	New York	1	1	1	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*31	*29	*30	May '20, K	0.03
Coniagas	Toronto			1.30	May '21, Q	0.12½
Crown Reserve	Toronto	*22	*19	*21	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅛	3⅛	3⅛	July '22, Q	0.12½
La Rose	Toronto	*30	*27	*27	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*24	*20	*20	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1.00	1.00	1.00	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	July '22, Q, X	0.30
Ontario Silver	New York	7⅛	7⅛	7⅛	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb			*12	Jan. '12,	0.10
Temiskaming	Toronto	*32	*30	*31	Jan. '20, K	0.04
Trethewey	Toronto	*5	*4½	*4	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*21	*18	*18		
Cash Boy	N. Y. Curb	*7	*7	*7		
Dolores Esperanza	N. Y. Curb	2⅛	2⅛	2⅛	July '22,	2.50
El Salvador	N. Y. Curb	*4	*3	*3		
Jim Butler	N. Y. Curb	*7	*6	*6	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	*4	*4	*4	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	*8	*7	*8	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1 1/16	1⅛	1 1/16	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*77	*69	*69		
Tonopah Extension	N. Y. Curb	1 3/16	1⅛	1 3/16	July '22, Q	0.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1⅛	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1 1/16	1⅛	1⅛	June '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*8	*8	*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*75	*70	*70	Dec. '20,	0.15
Chief Consol.	Boston Curb	5	5	5	May '22, Q	0.05
Consol. M. & S.	Montreal	25⅛	25⅛	25⅛	Oct. '20, Q	0.62½
Daly Mining	Salt Lake		†2.00		July '20, Q	0.10
Daly-West	Boston			1⅜	Dec. '20, Q	0.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2½	Apr. '21, K	0.05
Electric Point	Spokane	*5	*5	*5	May '20, SA	0.03
Federal M. & S.	New York	15⅛	13	15⅛	Jan. '09,	1.50
Federal M. & S. pfd.	New York	54⅜	50	53⅜	June '22, Q	1.25
Florence Silver	Spokane	*35	*35	*35	Apr. '19,	0.01½
Grand Central	Salt Lake	†*65	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	6⅜	6¼	6⅜	June '22, Q	0.15
Iron Blossom Con.	N. Y. Curb			*31	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	2.75	2.75	2.75	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*15	*14	*15	June '21, I	0.02
Prince Consol.	Salt Lake	*7½	*7	*7½	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*5	*4½	*4¾	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*8	*7	*7		
Standard Silver-Ld.	N. Y. Curb	*18	*18	*18	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*7	*6	*7	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.40	3.30	3.30	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.02½	1.97½	2.02½	Dec. '21, Q	0.05
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	*8	*7	*8	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	51⅛	48⅛	48⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	64	63½	63½	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal			83	July '22, Q	1.75
SULPHUR						
Freeport, Texas	New York	22⅛	20⅛	21⅛	Nov. '19, Q	1.00
Texas Gulf	New York	48⅛	47⅛	48⅛	June '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	61⅛	60⅛	61	Mar. '21, Q	1.00
Amer. Sm.& Ref. pf.	New York	98⅛	97½	98½	June '22 Q	1.75
Am. Sm. Sec. pf. A.	New York			92½	July '22, Q	1.50
U. S. Sm. R. & M.	New York	42	40⅛	42	Jan. '21, Q	0.50
U.S. Sm.R.& M. pf.	New York	48⅛	48⅛	48⅛	July '22, Q	.87½

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advance—Blue annealed steel sheets up 12c. in Chicago; 15c. in New York and 20c. per 100 lb. in San Francisco. Shapes and plates advanced 10c. at Pittsburgh mill; 15c. per 100 lb. in New York warehouses. Slight rise in hollow tile due to fuel shortage. Yellow pine structural timbers, base size, higher in Minneapolis and Birmingham; fir and spruce up in Montreal. Fire hose, 2½-in. coupled, up 2½c. per ft. Heavy leather belting and rawhide lacing discounts reduced, following rise in hides. Raw linseed oil up 1c. in New York and 5c. per gal. (5 bbl. lots) in Chicago, during month.

Declines—Cast-iron pipe down 50c. in Birmingham and $1.40 per ton in Chicago. Pine lumber declined $2 per M ft. in Chicago; fir hemlock and spruce lower in Denver. Average drop of ½c. per lb. on 40@60 per cent gelatin dynamite, throughout the country.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed No. 10	$2.40@$2.60	$3.62½	$3.75	$4.35	$3.78
Black No. 28	3.15@ 3.40	4.30	4.45	5.65	4.35
Galvanized No. 28	4.15@ 4.40	5.30	5.45	6.50	5.35

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$40.00	$45.00	.....	$40.00
Standard openhearth rails	40.00	47.00	$40.00	40.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.25@2.35	$3.00	$2.55	$3.00	$4.10	$2.80
Track bolts	3.00@3.50	4.00	3.65	4.25	5.10	3.80
Standard section angle bars	2.40	2.75	2.40	3.00	4.00	3.00

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.70@$1.80	$1.95	$2.83	$4.00	$2.57½	$2.68	$3.10
Channel, 3 to 15 in.	1.70@ 1.80	1.95	2.83	4.00	2.57½	2.68	3.10
Angles, 3 to 6 in., ¼ in. thick	1.70@ 1.80	1.95	2.83	4.00	2.57½	2.68	3.10
Tees, 3 in. and larger	1.70@ 1.80	1.95	2.83	4.00	2.57½	2.68	3.10
Plates	1.70@ 1.80	1.95	2.83	4.00	2.57½	2.68	3.10

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	30%
Cast steel round strand rope	32½%
Galvanized steel rigging and guy rope	17½%
Round strand iron and iron tiller	15%
Plow steel round strand rope	45%
Special steel round strand rope	40%

	New York	Cleveland	Chicago
Drill Rod (from list)	55@60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD—	..1 to 3	71	58½	⅜ to 1½	44½	29½
LAP WELD—	2½ to 6	68	55½	2½ to 6	42½	29½

STEEL PIPE—From warehouses at the places named the following discounts for hold steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	61%	59½%	56%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$53.30	$48.30	$37.00	$45.20	$39.70	$51.00

	New York	Cleveland	Chicago
Nuts, hot pressed, sq., per 100 lb. Off list	$2.00	$3.50	$4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00

MACHINE BOLTS	New York	Cleveland	Chicago
1½ and 1½x3 in. up to 12 in.	33⅓%	60%	60-10%
Button head bolts, with hex. nuts	25 %	$3.90 net	.....

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1112	$0.1232	$0.0741	$0.10	$0.0635	$0.108	.....
6x12x12	.1667	.1642	1.0190	.....	.08	.156	.....
8x12x12	.2084	.219	1.3900	.18	.12	.244	$0.17890

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers, in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$28.00	$31.00	$31.00	$33.00
3x6 and 8	28.00	31.00	31.00	34.00
4x4-6 and 8	28.00	31.00	32.00	35.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$38.00	$39.00	$41.50	$43.50
3x10 to 10x10	41.00	42.00	44.00	46.00
3x12 to 12x12	44.00	45.00	47.00	49.00

Other Cities	8 x8-In. x 20 Ft. and Under Pine	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir
Boston	$38.00	$39.00	$43.00	$48.50	$47.00	$39.00
Cincinnati	39.00	50.00	.....	.....	40.00	64.00
Montreal	50.00	50.00	35.00	38.00	78.00	50.00
Denver	.....	36.25	36.25	36.25	.....	37.25
Minneapolis	46.00	41.00	40.00	.....	49.00	41.00
Kansas City	41.25	44.00	.....	.....	47.00	46.00
Birmingham	28.00	.....	.....	.....	33.00	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.40@$2.50	$3.10	$3.90	$5.00	$3.25	$4.95
Cut	2.25	5.50	5.65	7.75	....	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.40@$2.50	$2.40@2.50	$2.80
Chicago, f.o.b.	2.05	2.05	2.17
Cleveland, f.o.b.	2.31	2.31	2.43

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel 280-lb.net Common
New York	$15.80@$16.17	$13.11	$3.63½	$2.75@$3.14½
San Francisco	22.00	16.00	....	(180-lb net) 1.75

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.91	$0.80	$1.01	$0.75

WHITE AND RED LEAD—Base price in cents per pound:

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Dry or In Oil	White Yr. Ago Dry or In Oil
100-lb. keg	12.50	14.00	13.00	14.50	12.50	13.00
25 and 50-lb. kegs	12.75	14.25	13.25	14.75	12.75	13.25

HOSE—

Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled	49½c per ft.
Air	First Grade / Second Grade
¾-in., 3 ply per ft.	$0.31 / $0.22½

Steam—Discounts from List

First grade.....40-10% Second grade.....50-5% Third grade....50-10-5%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition.....60-10-5% Best grade..... 60-5%

LEATHER BELTING—List price per ply, 12-in. wide, per lin. ft. $2.88.

Grade	Discount from list
Medium	40—5%
Heavy	30—5%

RAWHIDE LACING—For cut, best grade, 50-5%, 2nd grade, 55-5%. For laces in sides, best, 45c. per sq.ft.; 2nd, 43c. Semi-tanned: cut, 45-5%; sides, 47c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.20½	New Orleans	$0.17½
New York	.17	Los Angeles	.16½
Chicago	.19	Seattle	.18

COTTON WASTE—The following prices are in cents per pound:

	New York	Cleveland	Chicago
White	7.50@10.00	12.00	11.25
Mixed	5.50@ 9.00	9.00	8.00

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.2900	$0.3200
Minneapolis	.2092	.2295
Denver	.1775	.2075
Seattle	.175	.195
Cincinnati	.2350	.255
New Orleans	.2675	.3025
San Francisco	.195	.235

FLOTATION OILS—All prices are per gal., f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight 500 lb.

Pine oil, steam dist., sp.gr., 0.930-0.940	gal.	$1.00
Pine oil, pure, dest. dist	gal.	.95
Pine tar oil, ref., sp gr. 1.025-1.035	gal.	.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla	gal.	.35

INDUSTRIAL NOTES

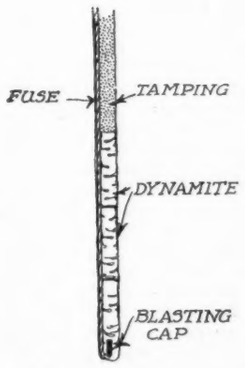
The Do and Don't of Loading Dynamite

Methods of correct loading of dynamite, showing the most efficient manner of preparing the explosive for work, together with illustrations of certain incorrect practices which are actually in use, are pointed out in a set of instructions just prepared by Arthur LaMotte, chief of the Technical Bureau of E. I. du Pont de Nemours & Co.

In large blasting operations, it is extremely important that special attention be given to the preparation of the detonator for the explosive charges. A misfire in such operations is a serious and dangerous matter. Although the subject of loading dynamite cartridges has been given attention for years, it has been found that some explosive users continue to use incorrect methods, thus not only creating what may develop into dangerous conditions, but actually losing money by the failure to get the most efficient results from the use of dynamite.

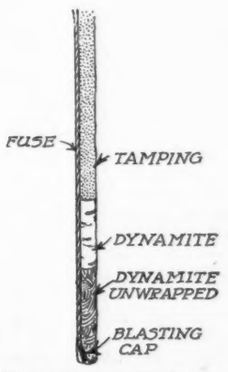
In the accompanying illustrations are shown six wrong ways of loading dynamite and two right ways.

SIX INCORRECT METHODS OF LOADING DYNAMITE (ILLUSTRATED BY THE FIRST SIX LINE CUTS) AND TWO WAYS OF LOADING THAT HAVE SHOWN THE MAXIMUM OF RESULTS AND ECONOMY (IN LOWER RIGHT-HAND CORNER OF THE PAGE)



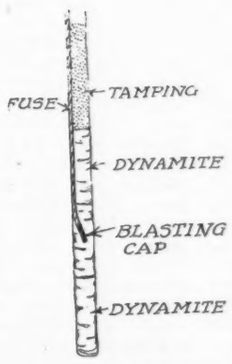
PRIMER AT BOTTOM OF CHARGE

The cap with fuse should NOT be placed at the bottom of the hole like this, as the side spit of the fuse would be likely to set fire to the dynamite.



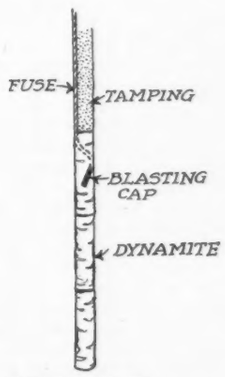
CAP AT BOTTOM OF CHARGE FUSE IN DIRECT CONTACT WITH DYNAMITE

This is bad practice, as the cap is pointed AWAY from the charge instead of toward it, and the fuse is also likely to set fire to the dynamite before the cap explodes.



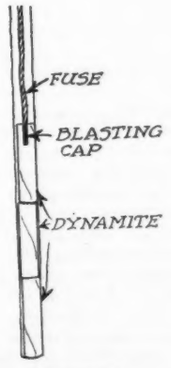
PRIMER IN CENTER OF CHARGE

The middle of the charge is not the right place to put the primer as the top cartridge does not receive the full force of the cap and the fuse may ignite the powder which touches it.



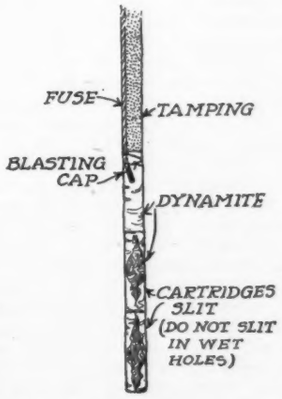
FUSE LACED THROUGH CARTRIDGE

Lacing the fuse through the priming cartridge is bad practice. It nearly always lets the fuse side spit into the dynamite.

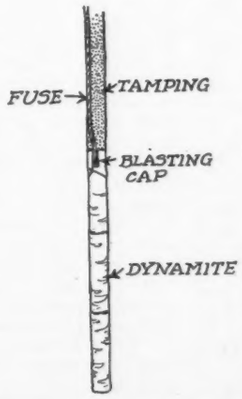


NO TAMPING. (PRIMER IN CORRECT POSITION)

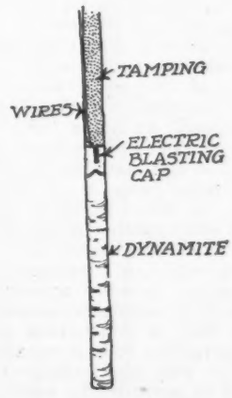
This kind of loading, without tamping, is expensive and inefficient, as the top cartridge wastes most of its force blowing out the hole. The Bureau of Mines reports that tamping increases the effectiveness of high explosives enormously.



If the holes are full of water the cartridges of dynamite should not be slit, as water affects nearly every kind of dynamite except gelatin.



This way, with the cap in the top of the TOP cartridge, pointing DOWN toward the bulk of the charge, with lots of tamping and no part of the fuse touching the powder, will give you a perfect shot every time.



If you fire electrically, you will get best results this way, as the electric blasting cap is placed so as to exert its MAXIMUM detonating effect on ALL the explosive in the charge.

INDUSTRIAL NOTES

Continued

Mine Pumps

Simplicity of Design, Resistive Properties and Uniformity of Metal, and Proper Care Make for Long Life.

By George A. Drysdale

BECAUSE of the severe requirements imposed, manufacturers are having great difficulty in producing satisfactory mine pumps. Obstacles which do not present themselves in pumps for ordinary use have to be overcome in producing a pump that will remain in good working condition for a reasonable period of time in a mine. A manufacturer who can produce a pump that will satisfactorily perform its function for a longer period of time than a competitor's pump, thus eliminating the heavy renewal expense which falls upon the buyer, can get business which covers a large field.

During the last few years, individuals and corporations, including the U. S. Bureau of Mines, have spent a great deal of money and time in experimenting to produce a metal or metals that will withstand the corrosive and erosive action of mine water. The majority of these have been laboratory tests; the minority have been conducted under the actual working conditions. The results obtained in the former instance are always questionable when applied to the latter conditions, as these working tests are the only ones that can be relied upon.

As a result of these experiments a few metals have been produced that are highly resistant to the attack of mine water. But when such metals are made up into pumps and installed in mines, new difficulties present themselves. We often hear that broad assertion "the pump is unsatisfactory; it will not do the work." In many instances we will have to look beyond the acid-resisting properties of the metal.

One of the main reasons for these failures is that the acid-resisting properties are depended on to too great an extent, and other highly important features ignored in perfecting a suitable and satisfactory pump for the mining industries. In other words, the resistance of the metal to acid is only one of the many reasons for a pump being "good" or going "bad."

One of the fundamental principles involved in the manufacture of a satisfactory mine pump is its simplicity of design. In other words, a pump that has the least number of parts that will do the work proves the best pump in the long run. A single-stage centrifugal pump is more satisfactory for such working conditions as are found in a mine than a multi-stage pump. In most operations it is more satisfactory to install two single-stage pumps, if required to perform the work, than one multi-stage pump. It is often the case that a multi-stage pump is installed that will take care of all excess water in a few hours and then remains idle for the rest of the day, where a single-stage pump could do the work satisfactorily, in a longer period of time but with more durability.

It is reasonable to assume that a mine pump will not receive the same care, owing to its location, as a pump above surface; consequently the least number of parts that may get out of order would make the most desirable pump for such conditions. This also eliminates, to a great extent, the heavy renewal expense which the mines now have to carry. The renewal expense includes the necessity of carrying a large stock of repair parts and the cost of constantly replacing the disabled parts.

Secondly, the design must call for a uniform thickness of its castings. In others words, the uniformity of thickness in the design gives more uniformity in the grain of the casting, regardless of the metal of which the castings are made; the finer the grain of the metal, the more acid resisting it becomes. The majority of pump manufacturers use the same patterns for gray iron castings as for their brass, bronze, and aluminum castings; the making up of two sets of patterns is very expensive. And, therefore, if the patterns made from the design are to be used for ferrous (gray iron) and non-ferrous (brass, bronze, or other non-ferrous alloys) metals alike, great care must be exercised that the thickness of the metal is as uniform as possible; otherwise the shrinkage problem will be difficult to overcome. (A pattern maker allows $\frac{1}{8}$-in. shrinkage, per foot, on the castings, as a general rule. This applies to cast iron, but the approximate shrinkage of the average non-ferrous metal is $\frac{1}{4}$ in. per foot.) When pouring, the mold made from such a pattern with non-ferrous metal, chills or other temperature control must be used to overcome excessive shrinkage, and this is expensive, and sometimes impracticable from a foundry standpoint.

Where there is the slightest tendency toward segregation, due to the metal not being of uniform thickness, when subjected to the water pressure test, the uneven parts will show up by sweating, and "piening" has to be resorted to. If such treatment fails to close the grain, these parts have to be welded and often the casting must be rejected. This involves a considerable loss and retards production.

When gray cast iron is used little or no trouble is experienced, but with the use of non-ferrous metals, such as brass and bronze, segregation becomes a serious obstacle. We also observe that these segregated parts are more readily attacked by the corrosive and erosive action of mine water, mainly because of their coarse grain, and consequent free access and penetration of the acid water. As an example: Two samples, of approximately the same weight, designated as A and B, were obtained from an acid-resisting alloy casting, so that A represented its thinnest part and B represented its thickest part, in the ratio of 1 to 2. Both samples were forwarded to a mine in West Virginia to be tested out in running water. The results were as follows:

Sample A lost in fourteen days, 1.78 per cent; in twenty-eight days, 2.35.

Sample B lost in fourteen days, 3.68 per cent; in twenty-eight days, 4.63.

In other words, the loss of the coarser-grained sample was approximately twice that having the finer grain.

No satisfactory mine pump has been made up of one acid-resisting metal; consequently, the problem resolves itself into using two or more metals. Where it is possible to produce an excellent acid-resisting metal in the form of castings, such metal is likely to possess low physical properties, and therefore the entire pump cannot be made of this metal. Also, a good acid-resisting metal can be produced that can readily be rolled and drawn, and gives high physical properties, but cannot be made into satisfactory castings. The shafts, bolts, nuts, and similar parts of a pump had best be made of such a metal, and the weaker parts made of the more suitable metal for castings. Such a combination will give a satisfactory pump, as far as the metal is concerned. In short, the two metals in combination give results which neither alone could give.

The packing used in mine pumps is of major importance to the life of the pump, and great care must be exercised in placing it. Fiber packing should, of course, not be used in pumps of this nature, nor should metallic packings, which are too readily corroded by acid water. There are a number of good metallic packings on the market, but it has been found that the pure lead foil, impregnated with graphite and oil, and rolled and shaped as required, has given the best results in mine pumps.

Treatment of the pumps in the mines is also of major importance, and the careless way in which the average mine pump is treated is one of the reasons why "the pump is unsatisfactory and will not do the work." For example, I have examined a number of pumps which have been returned as "no good" and found bearings burnt out, shafts scored, an absence of all lubrication, and a lack of, or inadequate, packing in the packing box.

The manufacturer is often requested to make guarantees in order to sell a pump for use in a mine. If this is done, it is only reasonable that the manufacturer request guarantees that the pump will receive at least ordinary care in the mine. And it should be mutually agreed that if, on examination, the pump has failed through lack of proper care in the mine, such as unnecessary abuse, lack of lubricants and other conditions, the burden should be assumed by the purchaser of the pump; but if, on the other hand, the pump has gone bad on account of faulty design, metal used, or poor workmanship, the manufacturer should assume the responsibility. It is only by co-operation along these lines that a pump can remain in good condition for any length of time.

The most perfect pump which a manufacturer can produce can "go bad" with improper care, and, again, the best of care on an impractical pump is of no avail in preserving it.

The metallurgical department of the Hill Pump Works division of the Midwest Engine Co., Anderson, Ind., in conducting their experiments, built up six or more small test pumps which were distributed through different parts of the country, choosing as their field the mines having the worst water to contend with (this department working in conjunction with the mine superintendents). The parts of these pumps were made of different metals and alloys, to show, by comparison, the superiority of any one metal over the other, in the test. These pumps were run for a period of six months, and, on the results obtained, specifications were made for the standard acid-resisting mine pumps which are now being supplied.